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14. ABSTRACT
Paints utilized for military purposes are formulated to stringent military specifications (MILSPECs). After the shelf life has expired, the paint can no longer be used for its original purpose/application. Furthermore, Navy policy prohibits the use of reformulated MILSPEC paint on anything classified as mission critical; therefore, treatment/ offsite disposal are the only two alternatives available for managing this waste. As a result, management and disposal of expired shelf-life (ESL) paint is the Navy's most expensive waste. ESTCP funded a demonstration to evaluate biological treatment of ESL paint as it appeared to be the most promising technology. NAVFAC ESC's system experience and data collation raised major issues related to aerobically digesting ESL paint under the current design. First and foremost is cost effectiveness. The highest cost, by far, is labor and electricity, due to the limited throughput of the system.

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LIST OF ACRONYMS AND SYMBOLS

BBP	Butyl benzyl phthalate
BOD	Biological Oxygen Demand
CAA	Clean Air Act
CFM	Cubic feet per minute
CHRIMP	Consolidated Hazardous Material Reutilization and Inventory Management Program
CNO	Chief of Naval Operations
CO_2	Carbon dioxide
COD	Chemical Oxygen Demand
COMNAV	Commander of Navy
CPVC	Chlorinated polyvinyl chloride
CWA	Clean Water Act
DEM/VAL	Demonstration/validation
DoD	Department of Defense
DOH	Department of Health
DRMO	Defense Reutilization and Marketing Office
EPA	Environmental Protection Agency
ESL	Expired shelf-life
FK-WTP	Fort Kamehameha Wastewater Treatment Plant
FTIR	Fourier Transform Infrared Spectroscopy
GAC	Granular activated carbon
H_2O	Water
HP	Horsepower
IWG	Inches of water gauge
IWTC	Industrial Waste Treatment Complex
JGDM	Joint Group on Depot Maintenance
MBAS	Methylene blue activated substances
MIB	Moisture Integrator Bubbler
MilSpecs	Military Specifications
MS	Moisture Separator
NAVFAC	Naval Facilities Engineering Command
NAVFAC ESC	NAVFAC Engineering Service Center
NAVFAC HI	NAVFAC Hawaii
ND	Non-detect
NEMA	National Electrical Manufacturer's Association
NPDES	National Pollutant Discharge Elimination System
NPT	Normal pipe threads
O&M	Operations and maintenance
PLC	Programmable logic controller
PVC	Polyvinyl chloride
RCRA	Resource Conservation and Recovery Act
SBR	Sequencing batch reactor

LIST OF ACRONYMS AND SYMBOLS - Continued

SBR-B	Sequencing batch reactor – B
SP	Standard pressure
STLC	Soluble threshold limit concentrations
SVOC’s	Semi-volatile organic compounds
TCLP	Toxicity Characteristic Leaching Procedure
TICs	Tentatively Identified Compounds
TKN	Total Kjeldahl Nitrogen
TOC	Total Organic Carbon
TPH	Total petroleum hydrocarbons
TSS	Total suspended solids
TTLC	Total threshold limit concentrations
TTO	Total toxic organics
TVS	Total volatile solids
UV	Ultraviolet
VOC’s	Volatile organic compounds
WRI	Wastewater Resources Incorporated
WWTU	Wastewater treatment unit
YO817	Pollution Abatement Technology Demonstration Program

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Also, I would like to acknowledge Steven Christiansen, Dennis Chang, Vernon Kam, and Kendall Au from Naval Base Hawaii for all of their support, without which this demonstration could not have taken place. Their support included, but was not limited to, negotiating with the regulatory agencies for their acceptance of the demonstration, providing paint for each test run, transferring liquor between reactors when required, and providing important analytical work when requested.

In addition, special thanks go out to Dr. Paul Usinowicz from Battelle and Theresa Hoffard from NAVFAC Engineering Service Center for their support and consultation during the demonstration, interpretation of the data, recommendations for improvements, and performance of critical analytical work with explanations of the results, respectively.

EXECUTIVE SUMMARY

The Naval Facilities Engineering Service Center (NAVFAC ESC), under the sponsorship of Naval Facilities Engineering Command and the Environmental Security Technology Certification Program (ESTCP), attempted to demonstrate and validate a full-scale treatment system for biodegrading hazardous expired shelf-life (ESL), solvent-based paint into nonhazardous byproducts. Previous research and studies suggested the application was an economically viable process that would reduce the Navy's highest per pound recurring cost.

Two parallel sequencing batch reactors, totaling a working volume of 8,600 gallons, and associated parts (can crusher, mixing tank, and air biofiltration system) were procured, installed, and tested over a 1-year period in cooperation with the Industrial Wastewater Treatment Complex (IWTC) in Pearl Harbor, Hawaii. Regulations required for successful treatment were at the federal, state, and local level and included: discharge requirements established by the Fort Kamehameha Water Treatment Plant (FK-WTP) for the water; toxicity characteristic leaching procedure (TCLP) requirements for the sludge; and Title V requirements for the air.

Six individual runs were performed on 3 different types of paint, each run lasting approximately 10 days. Runs 1and 6 were excluded from the results and analysis. Run 1 was an acclimation period, and for run 6, an atypical, new paint type was delivered that proved much more difficult to treat. For the liquid phase discharge, all requirements were met in runs 2 through 5, except for a few spikes that were addressed by further settling.

All solid phase requirements were met, and Title V requirements in the biofilter exhaust were met 83 percent of the time. However, despite the successful results for discharge requirements, more questions and issues were raised, and the costs to run the system were exorbitant. Issues of greatest concern are: the large quantity of organic matter found in the sludge, indicating incomplete degradation; the cost prohibitive use of granular activated carbon for air polishing; the inability to adequately shear and emulsify the paint; the possible requirement of a Part B permit; and the need for highly-trained personnel to operate the system. Finally, the biggest concern was the total cost of treatment. To run the system efficiently, calculations show the system requires $19.63 per gallon of paint; whereas hazardous disposal currently only costs $9.19 per gallon of waste. System payback is impossible and annual cost reductions are non-existent.

1.0 INTRODUCTION

1.1 BACKGROUND

Paints utilized for military equipment, structures, ships, submarines, and weapons are formulated to stringent military specifications (MILSPECs). After the shelf life has expired, the paint can no longer be used for its original purpose/application. Furthermore, Navy policy prohibits the use of reformulated MILSPEC paint on anything classified as mission critical; therefore, treatment/offsite disposal are the only two alternatives available for managing this waste. As a result, management and disposal of expired shelf-life (ESL) paint is the Navy's most expensive waste [1]. The problem is particularly acute on ships due to replenishment uncertainty; therefore, overstocked paint occurs when deployed, leading to the offloading of large quantities of ESL paint at their homeport. This is an issue that is not limited to the Navy. The Joint Group on Depot Maintenance (JGDM) has also identified disposal of waste paint as a high priority at Department of Defense (DoD) facilities and initiated a project to determine how much paint is collected and the associated disposal costs [2].

The implementation of the Consolidated Hazardous Material Reutilization and Inventory Management Program (CHRIMP) in the early1990s reduced the inventory of ESL solvent-based paint through recycling and non-mission critical reuse policies. However, due to the sheer quantities of ESL paint, activities continue to find themselves managing and ultimately disposing of ESL paint at a cost of $1.70 to $2.24 per pound, equaling a recurring cost to the Navy in excess of $6 M per year (1999 dollars) [1].

To address this problem, the Naval Facilities Engineering Command (NAVFAC) tasked the Naval Facilities Engineering Service Center (NAVFAC ESC) to investigate alternative management methods for ESL solvent-based paint that would concurrently reduce costs and liability associated with the current practice of off-site disposal. The Navy Environmental Sustainability Development to Integration Program (originally the Pollution Abatement Technology Demonstration Program (YO817)) funded the initial effort, which concluded that biological treatment was the most promising technology for treating ESL paint at considerable cost savings and reduction of liability. Other technologies evaluated were steam reforming, incineration, ultrafiltration, activated carbon, and photochemical oxidation. Because the paint is not suspended in water, its high viscosity and solids content preclude the use of ultrafiltration, activated carbon, and photochemical oxidation as primary treatment. However, these technologies are considered viable for processing byproducts generated from biologically treating solvent-based paint (e.g., wastewater, slurries).

Given the fuel value of ESL paint, incineration would be a strong candidate, if not the preferred candidate. However, in many states it is virtually impossible to obtain a permit to operate a hazardous waste incinerator. Capitol investment for steam reforming proved to be far too expensive; therefore, no further consideration was given to this technology. The demonstration of the biodegradability of resins, activators, and solvents found in bulk ESL solvent-based paint, coupled with the high cost of off-site disposal, created the need for a full-scale demonstration effort.

For the demonstration effort, two 4,627-gallon biological treatment plants were installed at the Industrial Waste Treatment Complex (IWTC) in Pearl Harbor, HI. The completely enclosed systems consist of can crushers, mixing tanks, treatment tanks, and one air biofiltration system capable of handling the exhaust from both systems. For each experimental run, paint was added along with nutrients and allowed to process for approximately 10 days, with monitoring and sampling being conducted periodically.

1.2 OBJECTIVE OF THE DEMONSTRATION

The overall project objective is to demonstrate and validate (DEM/VAL) the economic feasibility of biological treatment of ESL paint. Specific objectives derived from the pilot scale are:

- Construct and install a full-scale treatment system using commercially available components.
- Optimize operation of the system to treat ESL paint.
- Demonstrate that the degradation end products meet requirements for discharge and disposal.
- Facilitate technology transfer by acquiring design, cost, and performance data.

The long-term objective is to implement the use of biological reactors DoD-wide to reduce the cost and liability associated with the disposal of solvent-based paint.

1.3 REGULATORY DRIVERS

In addition to addressing the number one hazardous waste disposal problem within the Navy, the project addresses the following high-priority Navy Environmental Quality requirements:

3.I.11.b	Excess Hazardous Material Minimization
2.III.01.b	Advanced Control and Destruction for Hazardous Wastes

2.0 DEMONSTRATION TECHNOLOGY

2.1 TECHNOLOGY DESCRIPTION

2.1.1 Biological Wastewater Treatment

Biological treatment of organic rich wastewater is an attractive and very commonly used technology for the removal of dissolved organics and suspended organic solids. The process typically removes more than 90 percent of suspended organic solids and is the most cost-effective treatment available for dissolved organics. Because of its simplicity and versatility, the use of biological treatment has been expanded to treat a wide variety of biodegradable waste and has often become the method of choice for the remediation of contaminated soil and water. The basic requirement for the process is mixing a near neutral pH and, for most applications, an aeration system, which provides oxygen and additional mixing. The most common and widespread application of biological treatment is sewage treatment; but food processors, feedlots, the paper industry, oil refineries, and the automotive industry increasingly use onsite biological treatment for the disposal of their industrial organic waste.

Biological treatment systems are typically designed to promote the growth of the naturally occurring bacteria adapted for the targeted waste. Nitrogen, phosphorus, and small amounts of vitamins and amino acids are added to promote bacterial growth. The process requires a residence time adequate for the bacteria to fully degrade the organics present. In the case of industrial wastewater treatment, excessive concentrations of heavy metals, some organic compounds (such as chlorinated solvents), high salinity, extreme pH or temperature can hinder and, in some cases, even poison biological treatment systems. But these effects are usually transient and systems rapidly recover when normal conditions are restored.

The end product of biological treatment is carbon dioxide (CO_2), water (H_2O), biomass, inorganic solids, and insoluble organic residue. Biomass is inorganic solids, dead bacteria, cell remnants, and other insoluble organic residue. The volume produced depends upon the capacity of the system and the proportion of the food source that is converted to biomass versus the proportion used for energy. Because dead bacteria can be broken down and used as a source of nutrients by the active biomass, recycling solids back through the reactor can reduce the amount of biomass for disposal and promote more rapid degradation in the reactor. However, buildup will eventually force the periodic harvest and disposal of accumulated solids.

Additional leftover products from a biological treatment process include metals, insoluble organic matter, and other inorganic contents of the original media. Unless the concentration of metals exceeds allowable limits, this residue is usually nontoxic and nonhazardous and can be landfarmed, composted, or captured in a filter press and landfilled.

Most industrial biological treatment systems will also require air biofiltration. Industrial waste streams can often contain volatile and semi-volatile organic compounds (VOC’s and SVOC’s), and/or these compounds might be formed as intermediaries during the treatment process. The vigorous aeration and mixing enhance the release of these often-regulated compounds, resulting in emissions. To capture and degrade VOC’s and SVOC’s, air (vented from reactors) is passed through a biofilter packed with a coarse media that provides support for the growth of bacteria

(e.g., compost, wood chips, or polymeric beads). Typically, to ensure that the release of air meets all regulations, an activated carbon filter is added to the end of the air filtration process for polishing.

2.1.2 Biological Treatment System Design for the Treatment of Solvent-Based Paint in Pearl Harbor

Figures 2-1 and 2-2 show schematics of the paint can evacuation system and treatment reactor, respectively. An overall schematic view of the process is shown in appendix B. A detailed breakdown of system components and associated costs can be found in Sections 5.0 and 7.0 respectively. The host facility provided the building site and utilities (i.e., electricity, water, and compressed air for pneumatic valves) (Section 4.0).

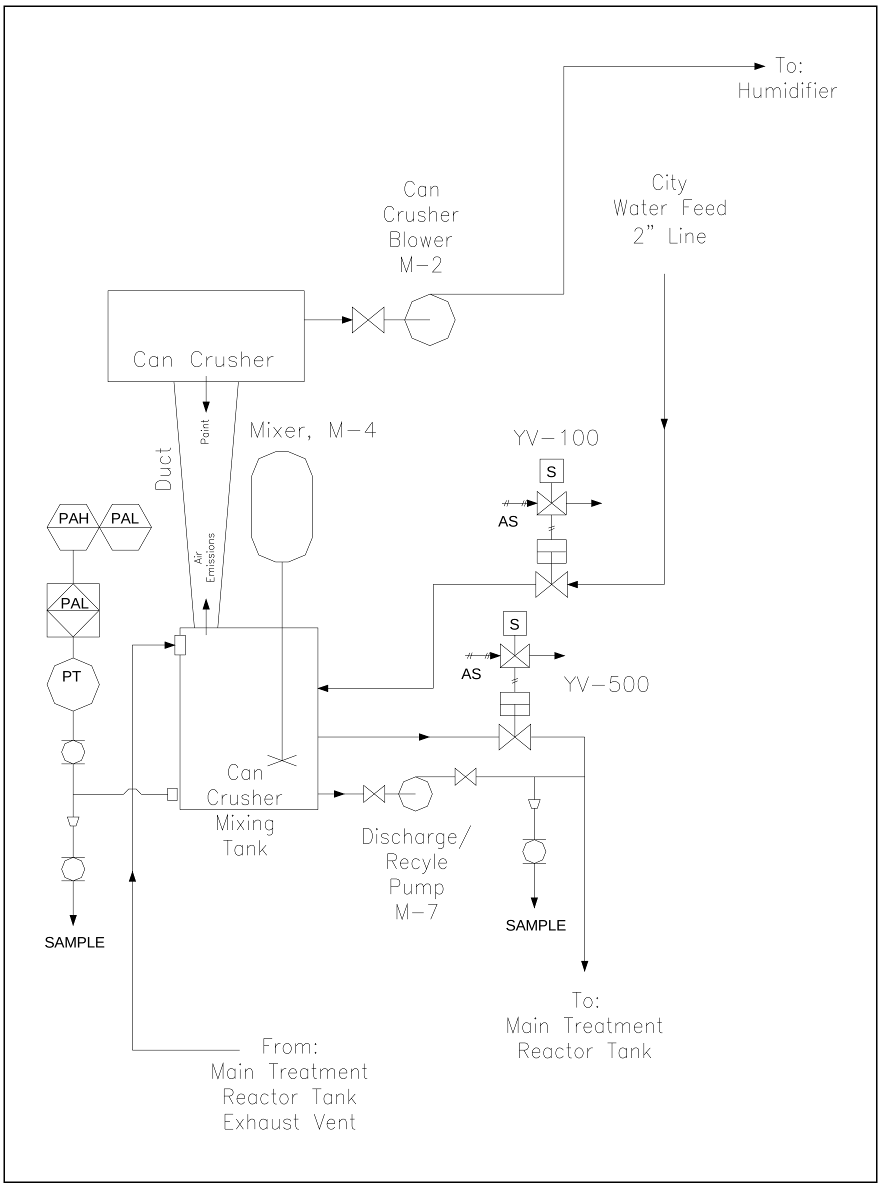


Figure 2-1. Schematic of paint can evacuation system.

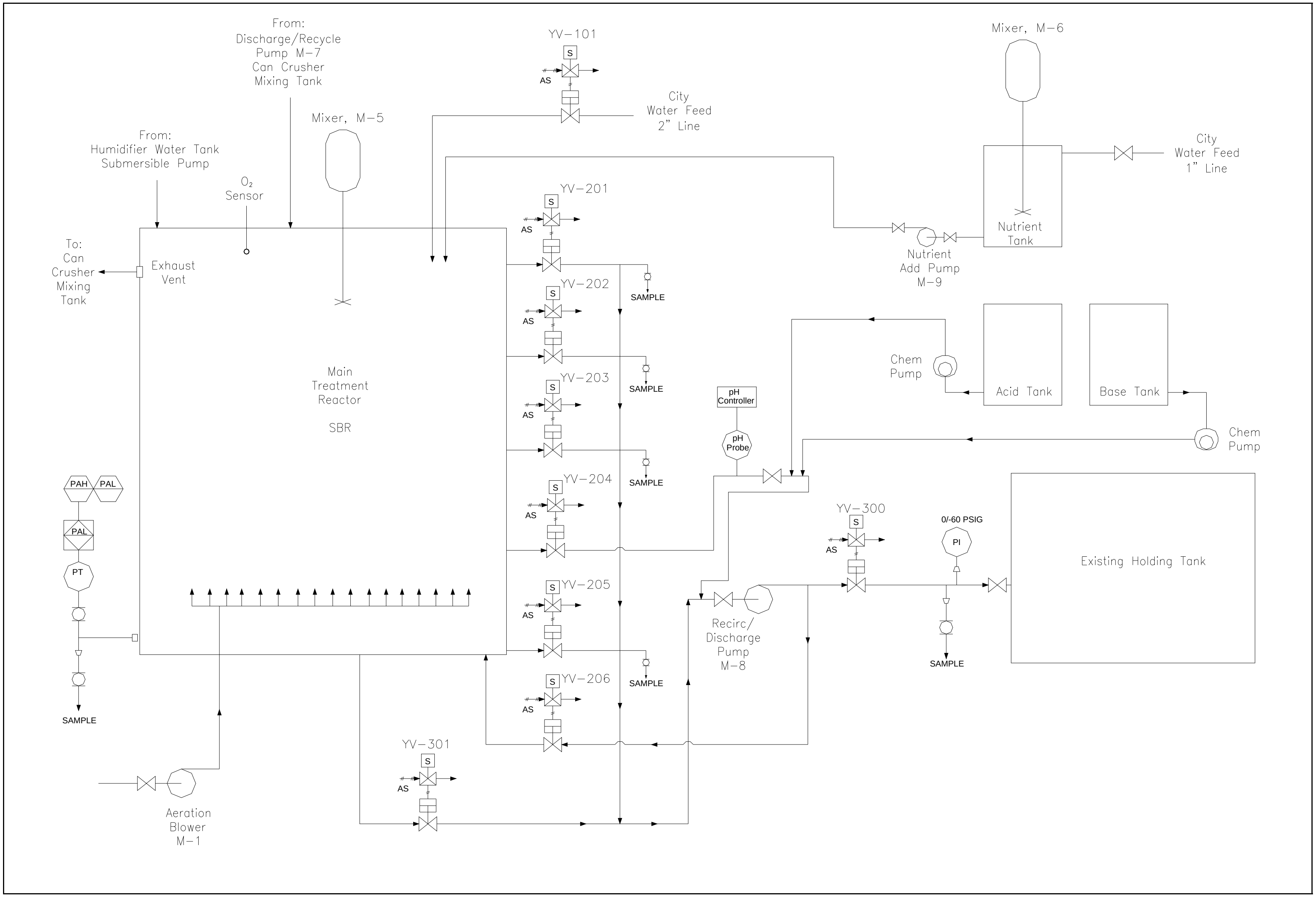


Figure 2-2. Schematic of treatment reactor.

Figure 2-3 shows the air biofiltration system. Figures 2-4 and 2-5 depict the system and its various parts after construction. Figure 2-4 is inside the building looking at Sequencing Batch Reactor B (SBR-B) and all of its components. Figure 2-5 shows the air biofiltration unit placed directly outside the IWTC building.

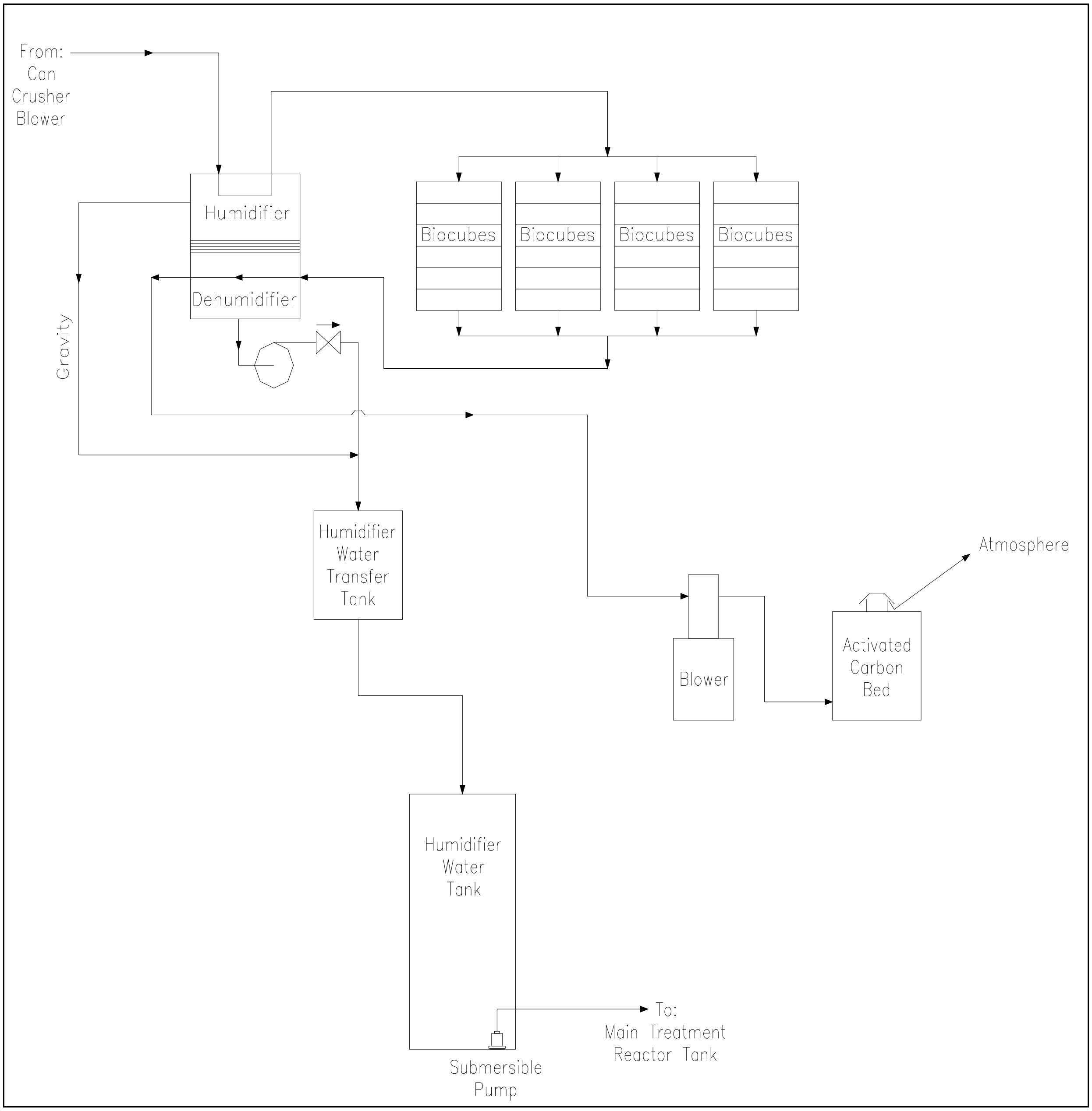


Figure 2-3. Schematic of air biofiltration system.

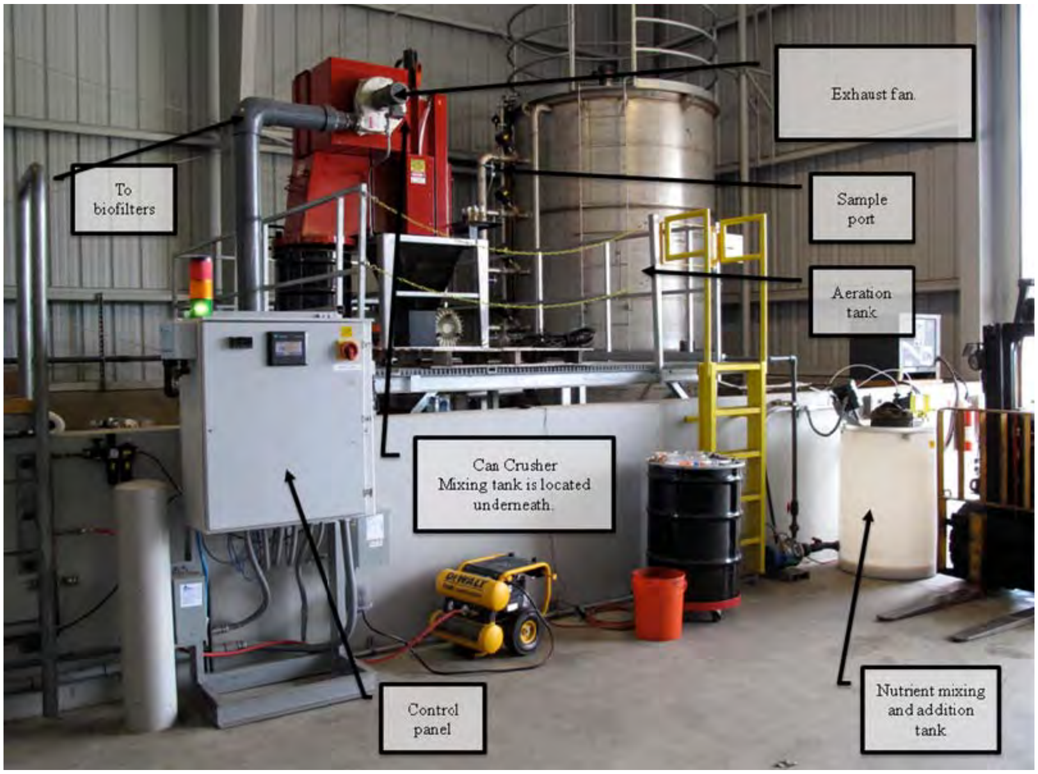


Figure 2-4. SBR-B.

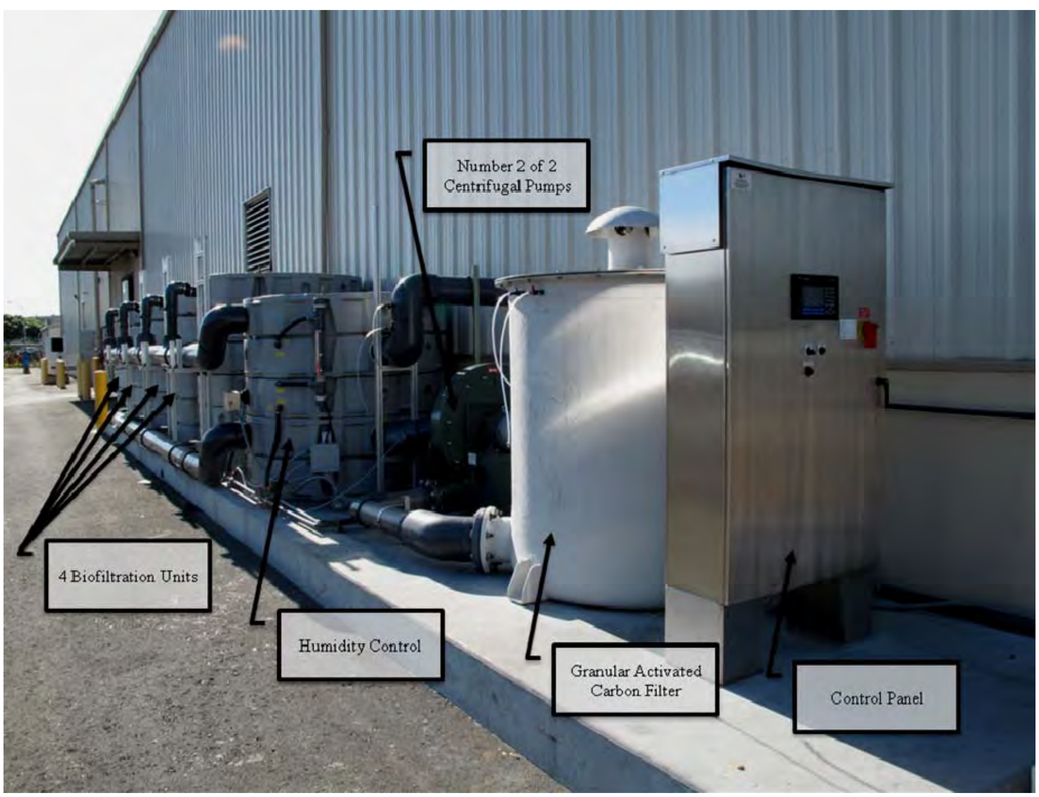


Figure 2-5. Air biofiltration.

Figure 2-6 shows the air flow through the entire ESL paint degradation system.

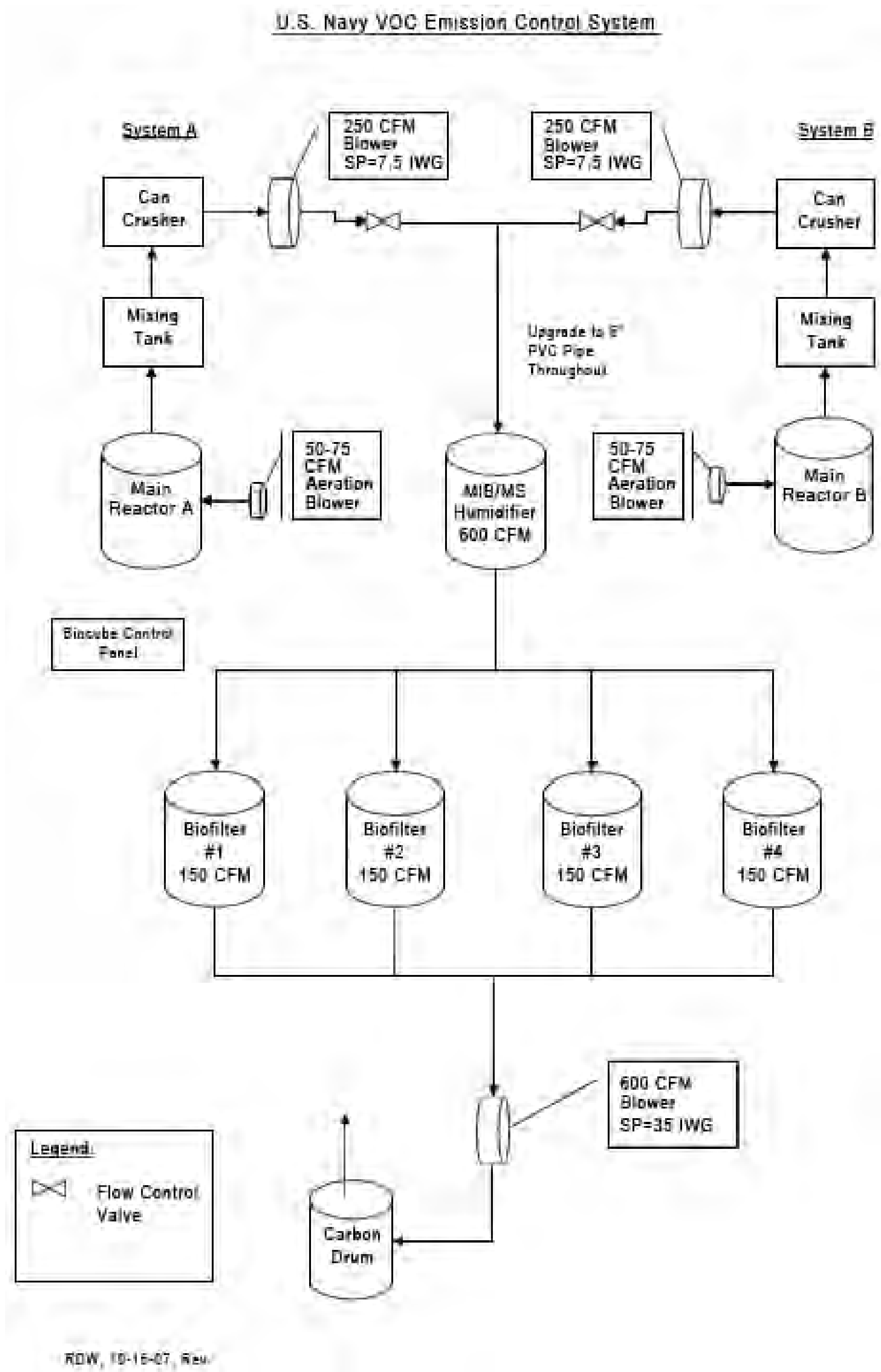


Figure 2-6. Flow diagram of complete ESL paint degradation system [SP = standard pressure; CFM = cubic feet per minute; IWG = inches of water gauge; MIB = Moisture Integrator Bubbler; MS = Moisture Separator].

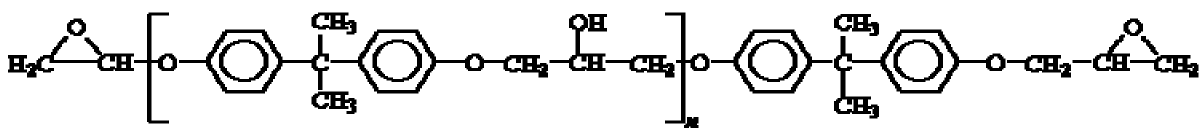
The project did not propose to treat specialty paints with heavy metals (such as anti-fouling paints), latex, or oil paints. Oil and latex paints were not included because they are not used aboard ships and have greater recycling potential. Specialty paints containing heavy metals were not included either, but could be treated, if provisions (e.g., precipitation, ion exchange, electrocoagulation) were made to capture the heavy metals following biodegradation of the solvents, resins, and activators.

2.2 TECHNOLOGY DEVELOPMENT

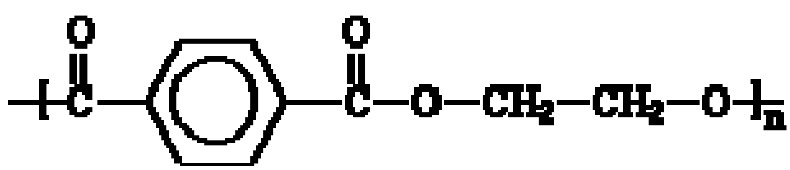
2.2.1 Paint Characteristics and Previous Paint-Degrading Studies

In 2004, under Chief of Naval Operations' (CNO) Pollution Abatement Ashore Program, NAVFAC ESC investigated technologies that may be used to treat ESL paints. Manufacturers, paints, and the chemical makeup of the paints were identified, and their respective formulations are detailed in TM-2368-ENV (2004) [3]. The paints that are the focus of this project are two-part paints in which the resin and activating agents are separately dissolved in solvents. The classification of these paints is based upon the structure of the film-forming resin and is identified as polyester, polyurethane, or epoxy. Film formation occurs when covalent bonds form between reactive groups on the resin and a cross-linking or activating agent. Structures of the most common resins are shown in figure 2-7.

a) epoxy



b) polyester



c) polyurethane

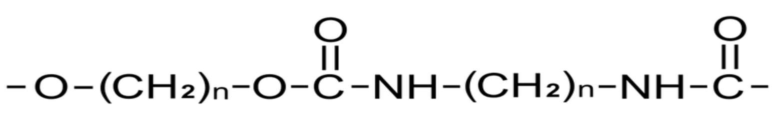


Figure 2-7. Representative structures of the ESL paint resins [(a) epoxy (diglycidyl ether of bisphenol-A, (b) polyester, and (c) polyurethane. The number of repeating units, "n" in the resins varies from 2 – 10.].

Paints consist of a variety of biodegradable organic compounds, typically solvents (30 to 80 percent by volume), film-forming resin (20 to 60 percent), pigment (2 to 40 percent), and other additives (0 to 5 percent) [4]. In uncured paint, the resins consist of short polymeric units held together by ester, ether, or amide bonds (figure 2-7). These bonds are identical to the bonds that form the chemical backbone of numerous natural products (e.g., triglycerides, cellulose, lignin, proteins, and chitin) for which bacteria have evolved a diverse array of enzymes that enable them to use these compounds as sources of food and energy. Thus, it would be expected that bacteria capable of degrading the short polymers that comprise paint resins already exist. In fact, pure cultures of bacteria that degrade each of the resins have been reported [5, 6, 7, 8, 9, 10, 11, 12]. Bacterial degradation of the solvents, which are a mixture of aliphatic and aromatic ketones and esters, is well established. In fact, biofilters are used to treat paint booth air emissions [13, 14, 15] and biodegradation is often the method of choice for the remediation of hydrocarbons and solvents in soil and groundwater [16].

Because paint is a mixture of resins, solvents, and activating agents, it is not practical to expect all of the components to be degraded by one organism. Rather, it is preferable to use a bacterial consortium in which individual organisms are adapted to degrading and growing on one or a few of the paint hydrocarbons. As a result, the bacteria act collectively to degrade the resins, solvents, and activators found in ESL paint. Because of the structural similarity between paint resins and solvents and petroleum hydrocarbons, bacteria adapted to degrade hydrocarbons found in oily sludge can be used as the source of paint-degrading bacteria. In addition to their paint-degrading capabilities, hydrocarbon degraders are adapted to grow on soluble and emulsified hydrocarbons and tolerate an environment that is often toxic to most organisms.

The degradation of paint does have a few specialty requirements due to its unique chemical makeup. For two-component paint, resins and activators should be added to separate reactors to prevent the formation of an insoluble and nonbiodegradeable film. This does not apply to pre-mixed paint which can be degraded without separating. To allow for efficient and rapid degradation, the insoluble resins, activators, and solvents found in ESL paints should be presented to the bacteria as a fine emulsion. This emulsion is critical to the biodegradation process because bacteria more rapidly colonize the surface of the emulsified resins, activators, and solvents. During the process, these bacteria convert the insolubles to soluble derivatives that are degraded by free-living bacteria. Emulsification is extremely important in the degradation of polyurethane resins, specifically with isocyanate groups. If complete hydrolysis does not occur, the alcohol that forms when the isocyanate hydrolyzes will form thick polyurethane foam that can consequentially result in system failure.

In addition to hydrocarbons, paint is also comprised of pigments, binders, and extenders. These nonorganic paint constituents are made up of magnesium silicate, barium sulfate, clay, calcium carbonate, and oxides of titanium, silicone, iron, and aluminum. Specialty paints may even have lead, cadmium, arsenic, beryllium, and chromium. With the exception of the heavy metals, the inorganic compounds found in paint are nontoxic and can be disposed with the biomass that accumulates in the treatment system.

2.2.2 Bench Scale

For the bench scale study, conducted in 2004, an oily sludge-degrading microbial consortia was used as the inoculum. The paint tested was a two-part polyurethane. The resin and activator were separately suspended in a mineral salts medium that contained potassium phosphate, ammonium sulfate, and traces of other salts. The medium was amended with yeast extract, providing vitamins and amino acids.

Experiments were conducted in 500-ml flasks with 200 ml of medium and 5 to 10 ml of paint (a 1:40 to a 1:20 ratio of paint to medium) was added and the flasks vigorously shaken. Samples were taken from the flasks at regular intervals and the optical density at 520 nm was measured as an indicator of bacterial growth. Samples were also extracted with hexane and then filtered with a 0.2-μm nylon filter and analyzed using gas chromatography and Fourier Transform Infrared Spectroscopy (FTIR). Spectometry results showed that while both components support significant growth, growth was slower on the activator. However, the chromatograms and FTIR analysis exhibited changes consistent with biodegradation and suggested that significant degradation had occurred. Full results, descriptions, figures, and explanations are detailed in TM-2368-ENV (2004) [3].

2.2.3 Pilot Scale

The technology description, detailed cost performance data and detailed results for the Pilot Scale study of degrading solvent-based paint can be found in TM-XXXX-ENV (2005) [17]. In summary, five 20-gallon stainless steel reactors, placed in sequence, were used for the pilot project, each fitted with an air-powered centrifugal pump for content recirculation and a pH controller to monitor and equalize acidic conditions during degradation. An exhaust blower, installed to sustain constant airflow throughout the system and maintain a slight negative pressure, regulated off-gas from the process. The air emissions were captured and treated in compost-filled biofilters. The residence time for the reactors was 10 days and the residence time of air in the biofilters was reported as approximately 10 minutes. Finally, a carbon filter was used to polish the exhaust air prior to venting it to the atmosphere.

Reactors were each charged with 1 gallon of paint (resin or activator, always separate) and approximately 20 gallons of water for each test. The recirculation pump was run for 8 – 12 hours before aeration and nutrient addition. For the initial test, a mixed culture of bacteria was obtained from a sequencing batch reactor (SBR) used to degrade oily sludge and, subsequently, sludge from the preceding test was taken to inoculate the next test (establishing a population of paint-degrading bacteria required 2 to 3 cycles of paint degradation). Nitrogen and phosphorus, required for bacteria proliferation was supplied by adding ammonium phosphate fertilizer. Yeast extract and peptone were added as sources of vitamins and amino acids.

The two-part solvent-based paints that were successfully treated are shown in table 2-1. This table includes the MILSPEC identifier for each of these paints and the monthly average quantity of each type of paint that is currently disposed of through NAVFAC Hawaii (NAVFAC HI) Environmental.

Table 2-1. MILSPEC identifiers of two-part ESL paints that can be treated biologically and current average monthly disposal volume for each type.

MILSPEC	Paint Type	Quantity (gallons per month)
24441	Epoxy Base and Catalyst	12,000
MIL-PRF 85285C	Polyester – Base and Activator	185
82851	Polyester Base and Activator	
MIL-PRF 85285 Type II	Isocyanate Resin and Activator	260

2.3 ADVANTAGES AND LIMITATIONS OF THE TECHNOLOGY

2.3.1 Alternative Technologies

Based upon the composition of the individual paints most commonly used, potentially applicable treatment technologies were identified and evaluated, such as biodegradation, carbon adsorption, incineration, photochemical oxidation, steam reforming, and ultrafiltration. Detailed information regarding all of these processes can be found in TM-XXXX-ENV (2005) [17].

Highly effective carbon adsorption is typically used for waste streams with less than 50 milligrams per liter (mg/L) of suspended solids and very low concentrations of insoluble oils. However, removing high concentrations of contaminants can be problematic and very expensive, and recovered contaminants from the regeneration process can require additional handling.

Incineration is effective in reducing the volume of waste, and if metals are within allowable limits, the ash can be typically landfilled. However, if the waste contains nitrogen, other byproducts can be produced in the incineration process that would require removal with additional equipment. Furthermore, permitting and operating a small onsite incinerator in most areas is very difficult and in California is prohibited.

Photochemical oxidation uses ultraviolet (UV) light and oxidants to oxidize organic material in a wastestream. It is a process more commonly implemented in drinking water where organic material and suspended solids are typically much lower than in a wastestream. Because of the makeup of a paint wastestream, the energy required for the lamps and the required light change frequency, the process would be cost-prohibitive for treating paint.

Like photochemical oxidation, ultrafiltration is used more commonly and is cost-effective in low solid streams. For a paint wastestream, the paint would have to be delivered to the membranes fully dissolved or suspended. Furthermore, because ultrafiltration does not necessarily remove or destroy hazardous components, additional treatment technologies would have to be applied.

Of the remaining technologies, only biological treatment and the physical chemical process known as steam reforming are appropriate for treating waste paint. Steam reforming uses heat to vaporize liquid or solid organic waste. The volatilized compounds are then mixed with

superheated steam and passed through a fluidized bed, converting them to carbon monoxide and hydrogen. It is a starting point for the synthesis of methanol. Consulting with a steam reforming, company, it was determined that ESL paint could be treated. However, further tests regarding the fate of nonvolatile resins and toxicity of the residue would be required.

To reduce the amount of residual biomass, highly organic waste streams can also be treated in an anaerobic digester, which has the added benefit of producing methane that can then be captured and used as fuel. However, anaerobic processes tend to be slower than aerobic processes, and the longer treatment times may require larger capacity systems than comparable aerobic systems.

Based upon the bench-scale studies conducted by NAVFAC ESC, it was determined that two-part paint, and more specifically, the activators and resins, can be biologically degraded. Therefore, an economic analysis was conducted to compare biological treatment to steam reforming. Biological treatment was calculated as the better choice with a lower initial cost and a payback of less than one year. More details of the analysis and costs are presented in Section 2.3.3.

2.3.2 Biological Treatment

Sequencing batch reactors for biological treatment is a mature technology, as described in Section 2.1, and is increasingly used to treat a variety of high biological oxygen demand (BOD) waste streams [16, 18, 19, 20, 21, 22, 23, 24, 25].

The main theoretical advantages of utilizing this technology for the treatment of paint are:

- Degrading nonvolatile resins, activators, and solvents;
- Degrading VOC's;
- Reducing paint management and handling required by land filling; and
- Operating a simple and relatively compact process.

The main limitations of the technology for the DEM/VAL are:

- Inadequate emulsification results in poor to no degradation;
- Excessive ESL paint loading impedes performance and poisons the system;
- Pilot study did not establish a viable paint-to-water ratio;
- High concentrations of heavy metals may poison the system;
- Pilot study did not analyze Total Toxic Organic (TTO) requirements; and
- Pilot study did not provide adequate data to demonstrate cost effectiveness.

Operational issues include:

- Handling and disposal of accumulated reactor sludge;
- Handling and disposal of biomass with excessive metals or other regulated compounds;
- Emulsifying paint adequately for digestion;
- Minimizing foam production during operation.

2.3.3 Pilot Study Economic Analysis

The full details of the economic analysis performed after the completion of the pilot study can be found in TM-XXXX-ENV [17]. In summary cost predictions were made based upon the following conditions: treatment of 2000 – 4000 gallons of paint per month; cost incurrences based upon the design, purchase, installation, and operation of a 10,000-gallon sequencing batch reactor in Pearl Harbor; and current costs of paint disposal based upon numbers provided (470,000 pounds of ESL paint at $1.98 per pound). Table 2-2 summarizes the predicted costs. Based upon the annual cost of $930,600 per year to dispose of the paint, the author of the pilot study predicted a payback of less than one year.

Table 2-2. Pilot study economic analysis summary.

Capital Equipment	**Cost**
Major Components	$200 - $400 K
Annual Recurring Operational Costs	
Labor Operation and Maintenance	$47.0 K
Utilities	$27.6 K
Residual Disposal	$3.6 K
Miscellaneous	$2.5 K
Total Annual Costs	$80.7 K

3.0 PERFORMANCE OBJECTIVES

Table 3-1 presents a summary of quantitative and qualitative performance objectives in the biological treatment of ESL paint.

Table 3-1. Quantitative and qualitative performance objectives.

Performance Objective	Data Requirements	Success Criteria	Results
Quantitative Performance Objectives			
Aerobic digestion of ESL paint	Establish a residence time in the reactor that balances cost and digestion requirements.	Demonstrate a residence time between 8 - 10 days.	A residence time of 4 days is required to reduce the overall treatment cost.
	Meet a predetermined level of paint degradation in reactor.	>95%	95% degradation in 0% test runs.
Post digestion-liquid phase	Discharge finished liquid to sewer by meeting EPA, DOH and COMNAV requirements.	Meet TTO, metals, and other miscellaneous requirements—See table 4-2 for constituent list.	- TTO requirements were met in 0% of the discharge samples. - TSS requirements were met in 100% of the discharge samples. - Heavy metal requirements were met in 100% of the discharge samples. - Miscellaneous metal requirements were met in 100% of the discharge samples.
Post digestion-solid phase	Dispose finished sludge.	Meet TCLP requirements as non-hazardous for metals and organics. See table 4-3 for constituent list.	- TCLP metal requirements were met in 100% of samples. - TCLP organics requirements were met in 100% of samples.

Table 3-1. Quantitative and qualitative performance objectives - Continued.

Performance Objective	Data Requirements	Success Criteria	Results
Quantitative Performance Objectives – Continued			
Post digestion-air phase	Establish biofilters to efficiently remove VOC compounds and meet exhaust Title V requirements.	95% or greater VOC removal.	- Biofilters were 22 to 93% efficient. - GAC filter met Title V requirements in 83% of instantaneous samples. However, total VOC removal met Title V requirements in 100% of test runs.
Cost Reductions	Show system payback.	Payback in < 2 years.	Payback is questionable in the current design and operational performance. More testing is required.
	Show annual cost reductions as compared to contract disposal.	< $9.19 per gallon	Operation and maintenance cost of $19.63 per gallon of paint under DEM/VAL operation with 60 gallon throughput.
Performance Objective	**Data Requirements**	**Success Criteria**	**Results**
Qualitative Performance Objectives			
System Parts	Component Procurement	Use readily available off-the-shelf components.	System was constructed from available off-the-shelf components.
System Assembly	Meet estimated timeline.	Reactors, pumps, valves, can-crusher, and biofilter procured and installed in three months.	Due to government mechanism (BAA) to hire contractor, significant deficiencies were revealed after initial installation was completed. Timeline extended three years to correct deficiencies.

Table 3-1. Quantitative and qualitative performance objectives – Continued.

Performance Objective	Data Requirements	Success Criteria	Results
Qualitative Performance Objectives – Continued			
Start-up and Optimization	Meet estimated time-lines.	Start-up within one month of installation.	After installation issues were resolved, the system was successfully started up within one month.
		Optimization within two runs.	Optimization was not reached during the DEM/VAL.
Ease of Operation	Incorporate automation.	Minimize operator time and requirements.	Manpower was reduced to the maximum extent possible.
Operator Safety	Operate system without creating safety hazards.	Meet all Fire, OSHA, etc. requirements.	All requirements were met.
Operational Requirements	Perform routine operational tasks.	No system failure due to operational task neglect.	The system was not hindered by operational neglect during the entire DEM/VAL.
Maintenance Requirements	Perform routine maintenance and calibration.	No system failure due to maintenance neglect.	The system was not hindered by maintenance neglect during the entire DEM/VAL.
Reliability	Operate system as designed.	No equipment failures.	No component failure except for two centrifugal pumps due to incompati-bility with the constituents of the waste stream. This was an additional contractor issue.

4.0 SITE/PLATFORM DESCRIPTION

4.1 TEST PLATFORM FACILITIES

Within the Navy, the primary source of ESL paint is the fleet. Therefore, potential test sites were limited to Navy activities that support the fleet (i.e., Pearl Harbor, HI; San Diego, CA; Norfolk, VA; Puget Sound, WA; and Yokosuka, Japan). Pearl Harbor was selected as a prime test platform for two particular reasons: 1) as a Naval fleet support activity, it is a primary source of ESL paint; and 2) onsite ESL treatment would provide additional cost savings by eliminating the need to ship the paint to the mainland for disposal.

The IWTC, located adjacent to Pearl Harbor Shipyards Drydock #4, is a state-of-the-art complex completed in 1997. A separate building houses offices and an environmental lab. The treatment facility encompasses 24,000 square feet and houses wastewater treatment tanks, precipitation tanks, a UV peroxidation unit, a reverse osmosis/ultrafiltration unit, and a filter press.

Located inside the building were two idle bays. The interior of one of the bays, prior to the installation of the aerobic digesters, is shown in figures 4-1 and 4-2. The bays, measuring 44 feet wide by 18 feet high and enclosed by retaining walls measuring 4 feet, 2 inches high, already met all safety and secondary containment requirements.

4.2 PRESENT IWTC OPERATIONS

The IWTC currently stores and treats waste generated by federal government facilities in the State of Hawaii. The hazardous waste storage permit allows the facility to store up to 27,280 gallons of segregated waste in designated storage bays prior to either treatment or offsite disposal.

Treated wastewater is discharged to the Navy-operated Fort Kamehameha Wastewater Treatment Plant (FK-WTP), a National Pollutant Discharge Elimination System (NPDES)-permitted facility Prior to discharge the wastewater is tested to ensure compliance with the pretreatment NPDES permit. Any sludge that may be generated during treatment is captured in a filter press, drummed, and disposed of through the Defense Reutilization and Marketing Office (DRMO).

4.3 SITE-RELATED PERMITS AND REGULATIONS

Under the Resource Conservation and Recovery Act (RCRA) of 1976, the United States Environmental Protection Agency (EPA) classifies ESL solvent-based paints as solid waste [any discarded material that is abandoned (i.e., disposed of, incinerated, accumulated, stored, or treated)]. The EPA regulates ESL solvent-based paints based upon their makeup of various toxic organic compounds, their ignitability, and the priority metals in the paint. Because many of the paint's individual constituents are termed hazardous, paint is controlled from "cradle-to-grave" (generation, transportation, treatment, storage, and disposal) as a hazardous waste for not meeting ignitability and toxicity requirements. The categorical codes used to classify paints are D001 (ignitability), D005 (barium), D007 (chromium), and D035 (EPA Toxicity).


Figure 4-1. South bay of IWTC prior to installation of SBR-B.


Figure 4-2. South bay of IWTC inside retainment wall.

Because paint is a federally regulated waste, treating paint for disposal will likely require a Part B permit issued by the EPA or State. Regulation 40 CFR 264.1(g)(6) excludes owners or operators of an elementary neutralization unit or a wastewater treatment unit (WWTU), as defined in §260.10, from a Part B permit. However, a biological treatment system for processing ESL solvent-based paint is not classified as a WWTU and would subsequently require a Part B permit, even though water generated from the process would most likely be discharged to a NPDES-permitted facility.

NAVFAC HI's Environmental Department initiated discussions with the Hawaii EPA's Department of Health (DOH) to acquire permission to demonstrate and validate onsite treatment of ESL solvent-based paint. Permission was granted to proceed with the effort provided that no paint waste is used during the demonstration phase. The DOH also required the use of activated carbon to polish any emissions generated from this process. Both of these requirements were adhered to throughout the demonstration. In addition, water generated or used by the process was tested prior to discharge to ensure compliance with the IWTC pretreatment NPDES permit requirements. All other waste byproducts (i.e., sludge, crushed paint cans) were also disposed of according to federal, state, and local requirements.

Because biological degradation of paint has never been done before, obtaining proper permits and following specific regulations becomes a combined effort of both the treatment and regulatory parties. Prior to design, installation, or processing, an activity wishing to use this type of system should consult with regulatory agencies on the local, state and federal levels.

4.3.1 Post-Digestion Liquid Fraction

In accordance with the Clean Water Act (CWA) of 1972, the National Pretreatment Program established pretreatment standards for controlling the passage, interference and incompatibility of nondomestic wastes to publicly owned treatment works. All discharges must meet the standards specified in 40 CFR 403, 'General Pretreatment Regulations for Existing and New Sources of Pollution', and any local limits established by the treatment plant. In addition, the discharge from the process falls under 40 CFR 403.6, 'National pretreatment standards: Categorical standards', which specifies quantities or concentrations of pollutants or pollutant properties that may be discharged by new industrial users. TTO is a categorical standard set by this regulation, and although the IWTC in Pearl Harbor does not fall within the parameters requiring regulation under the CWA, the local municipal treatment plant imposed the TTO standard. TTO's are often catered to the waste stream and because this is a new process, specific standards do not exist. To rectify the problem, the standards for "Electroplating and Metal Finishing" from 40 CFR 413.14 were utilized. Table 4-1 is the complete list of organics regulated in the waste stream. If the process becomes more widely used, regulators could change or expand the list to better represent a biological paint-treatment process. Limits on TTO for electroplating and metal finishing for a system discharging more than 10,000 gallons per day are 2.13 mg/L. This applies to this system because it is not a stand-alone system, but is a part of the overall discharge for the IWTC.

Table 4-1. List of organics regulated by TTO requirements set forth by the FK-WTP.

Organics	
Acenaphthene	Pentachlorophenol
Acrolein	Phenol
Acrylonitrile	Bis (2-ethylhexyl) phthalate
Benzene	Butyl benzyl phthalate
Benzidine	Di-n-butyl phthalate
Carbon tetrachloride (tetrachloromethane)	Di-n-octyl phthalate
Chlorobenzene	Diethyl phthalate
1,2,4-trichlorobenzene	Dimethyl phthalate
Hexachlorobenzene	1,2-benzanthracene
1,2-dichloroethane	(benzo(a)anthracene)
1,1,1-trichloroethane	Benzo(a)pyrene (3,4-benzopyrene)
Hexachloroethane	3,4-Benzofluoranthene
1,1-dichloroethane	(benzo(b)fluoranthene)
1,1,2-trichloroethane	11,12-benzofluoranthene
1,1,2,2-tetrachloroethane	(benzo(k)fluoranthene)
Chloroethane	Chrysene
Bis (2-chloroethyl) ether	Acenaphthylene
2-chloroethyl vinyl ether (mixed)	Anthracene
2-chloronaphthalene	1,12-benzoperylene
2,4,6-trichlorophenol	(benzo(ghi)perylene)
Parachlorometa cresol	Fluorene
Chloroform (trichloromethane)	Phenanthrene
2-chlorophenol	1,2,5,6-dibenzanthracene
1,2-dichlorobenzene	(dibenzo(a,h)anthracene)
1,3-dichlorobenzene	Indeno (1,2,3-cd) pyrene)
1,4-dichlorobenzene	(2,3-o-phenylene pyrene)
3,3-dichlorobenzidine	Pyrene
1,1-dichloroethylene	Tetrachloroethylene
1,2-trans-dichloroethylene	Toluene
2,4-dichlorophenol	Trichloroethylene
1,2-dichloropropane	Vinyl chloride (chloroethylene)
1,3-dichloropropylene (1,3-dichloropropene)	Aldrin

Table 4-1. List of organics regulated by TTO requirements set forth by the FK-WTP – Cont'd

Organics - Continued	
2,4-dimethylphenol	Dieldrin
2,4-dinitrotoluene	Chlordane (technical mixture and metabolites)
2,6-dinitrotoluene	4,4-DDT
1,2-diphenylhydrazine	4,4-DDE (p,p-DDX)
Ethylbenzene	4,4-DDD (p,p-TDE)
Fluoranthene	Alpha-endosulfan
4-chlorophenyl phenyl ether	Beta-endosulfan
4-bromophenyl phenyl ether	Endosulfan sulfate
Bis (2-chloroisopropyl) ether	Endrin
Bis (2-chloroethoxy) methane	Endrin aldehyde
Methylene chloride (dichloromethane)	Heptachlor
Methyl chloride (chloromethane)	Heptachlor epoxide
Methyl bromide (bromomethane)	(BHC-hexachlorocyclohexane)
Bromoform (tribromomethane)	Alpha-BHC
Dichlorobromomethane	Beta-BHC
Chlorodibromomethane	Gamma-BHC
Hexachlorobutadiene	Delta-BHC
Hexachlorocyclopentadiene	(PCB-polychlorinated biphenyls)
Isophorone	PCB-1242 (Arochlor 1242)
Naphthalene	PCB-1254 (Arochlor 1254)
Nitrobenzene	PCB-1221 (Arochlor 1221)
2-nitrophenol	PCB-1232 (Arochlor 1232)
4-nitrophenol	PCB-1248 (Arochlor 1248)
2,4-dinitrophenol	PCB-1260 (Arochlor 1260)
4,6-dinitro-o-cresol	PCB-1016 (Arochlor 1016)
N-nitrosodimethylamine	Toxaphene
N-nitrosodiphenylamine	2,3,7,8-tetrachlorodibenzo-
N-nitrosodi-n-propylamine	p-dioxin (TCDD)

In order to discharge to the FK-WTP, the COMNAV Pearl Harbor Base Limits for discharge of treated water from the IWTC to the sanitary sewer also had to be met. These limits are detailed in table 4-2.

Table 4-2. COMNAV discharge requirements.

Parameter	Maximum Concentration of Contaminants for Toxicity Characteristic (mg/L)	COMNAV Base limit (mg/L)
Ag	5.0	0.43
As	5.0	0.50
Ba	100	50
Be	N/A	0.20
Cd	1.0	0.69
Cr	5.0	2.77
Cr^{6+}	N/A	0.50
Cu	N/A	3.38
Hg	0.2	0.05
Mn	N/A	N/A
Ni	N/A	3.98
Pb	5.0	0.69
Se	1.0	0.90
Sn	N/A	10.0
Ti	N/A	0.50
Zn	N/A	2.61
pH Range	$2 \underline{<>} 12.5$	5.5 – 9.5
Total Cyanide	N/A	1.20
Sulfide	N/A	5.0
TOC	N/A	1200
TPH	N/A	25
Oil and Grease	N/A	150
Nitrites	N/A	5.0
Hydrazine	N/A	5.0
Peroxide	N/A	5.0
Chlorine	N/A	50
TSS	N/A	600
MBAS*	N/A	30
TTO	2.13	2.13

*MBAS-Methylene blue activated substances

4.3.2 Post-Digestion Solid Phase

Under RCRA, paint must be accounted for from ‘cradle to grave’, therefore rendering the post-digestion accumulated solids (biomass, inorganic material, and untreated paint residue) as solid waste. In order to landfill or compost, the Toxicity Characteristic Leaching Procedure (TCLP) must be performed on metals and organics. These are listed with their respective limits in table 4-3.

Table 4-3. Maximum TCLP concentrations for metals and organics allowed for disposal of sludge as a non-hazardous waste.

Metal	**Regulatory Levels (mg/L)**
Arsenic	5.0
Barium	100.0
Cadmium	1.0
Chromium	5.0
Lead	5.0
Mercury	0.2
Selenium	1.0
Silver	5.0
VOC’s	**Regulatory Levels (mg/L)**
Vinyl Chloride	0.2
1,1-Dichloroethene	0.7
2-Butanone (MEK)	200.0
Chloroform	6.0
Carbon Tetrachloride	0.5
1,2-Dichloroethane	0.5
Benzene	0.5
Trichloroethane (TCE)	0.5
Tetrachloroethene (PCE)	0.7
Chlorobenzene	100
1,4-Dichlorobenzene	7.5
SVOC’s	**Regulatory Levels (mg/L)**
Pyridine	5.0
2-Methylphenol	200.0
Hexachloroethane	3.0
4-Methylphenol	200.0
Nitrobenzene	2.0
Hexachlorobutadiene	0.5

Table 4-3. Maximum TCLP concentrations for metals and organics allowed for disposal of sludge as a non-hazardous waste - Continued.

SVOC's - Continued	Regulatory Levels (mg/L)
2,4,6-Trichlorophenol	2.0
2,4,5-Trichlorophenol	400.0
2,4-Dinitrotoluene	0.13
Hexachlorobenzene	0.13
Pentachlorophenol	100.0

The sludge-disposal requirements are federal, but the state can always make more stringent regulations. In addition to metal contamination, the post-degradation sludge collected from the bottom of the tank for disposal should be tested for paint residues, total metals, solids, organics and inorganics to determine the level of degradation of the paint and to verify that the metal will remain in a non-leachable state.

4.3.3 Post-Digestion Air Phase

Finally, in accordance with the Clean Air Act (CAA), Title V operating permits are required for potential air-polluting systems. A public comment period of 30 days and an EPA review of 45 days (not necessarily concurrently) are required for the permitting process. State and local authorities typically issue these permits after the source has begun to operate. Requirements are that exhaust air must have 95 percent or greater removal of VOCs before emitting to atmosphere.

5.0 TEST DESIGN

5.1 BENCH-SCALE TESTING

As described in Section 2.2.2, NAVFAC ESC conducted bench scale feasibility testing of solvent-based paint. Full descriptions and results can be found in the TM-2368-ENV (2004) [3]. Results demonstrated that both resins and activators of two-part solvent-based paints could possibly be degraded provided conducive conditions.

5.2 PILOT-SCALE TESTING

Described in Section 2.2.3, NAVFAC ESC conducted a pilot study of an aerobic digestion for solvent-based paint in Pearl Harbor, HI. Full details and results of this project are included in TM-XXXX-ENV (2005) [17].

Five 20-gallon stainless steel sequence reactors were installed for the pilot project, as well as air-powered centrifugal pumps, pH controllers, an exhaust blower, compost-filled biofilters, and an activated carbon drum. The residence time for the reactors was set at 10 days and the residence time of air in the biofilters was estimated at 10 minutes. One gallon of paint (resin or activator, always separate) and approximately 20 gallons of water were used for each test. Nitrogen and phosphorus, required for bacteria proliferation was supplied by adding ammonium phosphate fertilizer. Yeast extract and peptone were added as sources of vitamins and amino acids.

According to the pilot results, 4 two-part solvent-based paints were successfully treated and degraded, although the testing on the water phase was limited to FTIR spectroscopy and the COMNAV regulations. No TTO analysis was completed. Analysis of the solids generated during the pilot study indicated that the solids are not hazardous and the levels of priority metals were below the total threshold limit concentrations (TTLC) for landfilling.

5.3 FULL-SCALE DEMONSTRATION/VALIDATION DESIGN AND INSTALLATION

Two treatment systems were positioned inside the 2 free bays within the IWTC. The selection was based on space availability and the minimization of site preparation costs. Subsequently, utilities (i.e., air, electricity, and water) were provided for the 2 free bays (figures 4-1 and 4-2) to accommodate system requirements. Electrical service (100 amps) was provided to run both systems, including the biofilters. A 2-inch freshwater line and a 1-inch air line were also provided for each bay. All tanks, pumps, and can crushers were placed inside the bays for secondary containment. The system motor control panels, pH adjustment subsystems, and the nutrient-addition subsystems were placed outside the bays.

Outside the IWTC complex, a pad was poured for accommodating the biofilter system. The biofilter system, including the motor control panel, was placed on top of the pad. A humidifier water transfer system was placed adjacent to the biofilter system motor control panel.

Exhaust ports for all tanks and can crushers were plumbed together and, subsequently, plumbed into the biofilter system. This ensured that all air streams generated during the treatment process were treated prior to discharge to the atmosphere. Sampling ports were provided at the inlet (discharge side) of the biofilters and at the discharge side of the activated carbon tank.

Stainless steel tanks and piping were used for all equipment that came in direct contact with the system liquor. Schedule 80 PVC piping was used for all airways. Flow meters and manual valves were installed at the discharge side of the blowers on the can crushers for air control.

All electrical components and motors placed inside the bays required a National Electrical Manufacturer's Association (NEMA) 7 rating. In addition, installation of all conduit and conductors were installed in conformance with NEMA 7 requirements. All other electrical installations, including subsystems and system motor control panel installed outside the bays, did not require NEMA 7 rating. Figures 2-1, B-1, 2-2 and 2-3 depict the schematic, set-up, and system flow.

5.3.1 Equipment

Each system is comprised of the following equipment.

Can Crushers

The electric pail can crusher is a Super 6 PJ-XVC-5HP, equipped with a five horsepower (hp), explosion-proof motor; the vapor control package; and an automatic door. It is manufactured by TEEMARK Corporation. Each crusher is equipped with a Cincinnati fan, powered by a 1-hp motor that is capable of moving 500 CFM of air. Figure 5-1 shows the can crusher for system B.

Figure 5-1. Can crusher.

The can crusher can handle a wide range of paint cans, aerosol cans, and pails (with a maximum of 5 gallons) and is designed to crush every 8 seconds. The liquid contents of the cans are collected in the mixing tank, located directly below the can crusher. The crushed cans are collected in a separate 55-gallon drum for disposal or recycling. The propellants and VOCs are vented to the biofilters by the blower.

The can crusher is equipped with a safety interlock system that is linked to the crusher chamber door. The interlock system prevents operator injury by stopping all functions of the machine in the event that the crushing chamber door is opened during the crushing process. In addition, the hydraulic motor and oil cooler motor are interlocked with the blower motor. So, if for any reason the blower motor should experience low voltage or loss of voltage, all motors will stop.

Mixing Tanks

Each tank was fabricated out of stainless steal and equipped with two penetrations on top of the tank. One penetration consisted of a 4-inch port welded with a 150-lb flange for supporting a mixer and the other penetration consisted of a 12-inch-wide by 12-inch-long square opening for collecting paint. Figure 5-2 shows a mixing tank. A special duct (figure 5-3) was constructed to connect the can crusher paint discharge opening to the mixing tank inlet opening in order to prevent the contents (paint, VOCs, and/or propellants) from escaping to the atmosphere during the can-crushing process . Later, an additional eight-inch-long by eight-inch-wide penetration was made on top of the tank for access. This penetration was sealed with Plexiglas to allow visual observations of the mixing process. The dimension of the tank is 4 feet in diameter by 4 feet tall with a total volume of 376 gallons and a working capacity of 281 gallons.

Figure 5-2. Mixing tank.

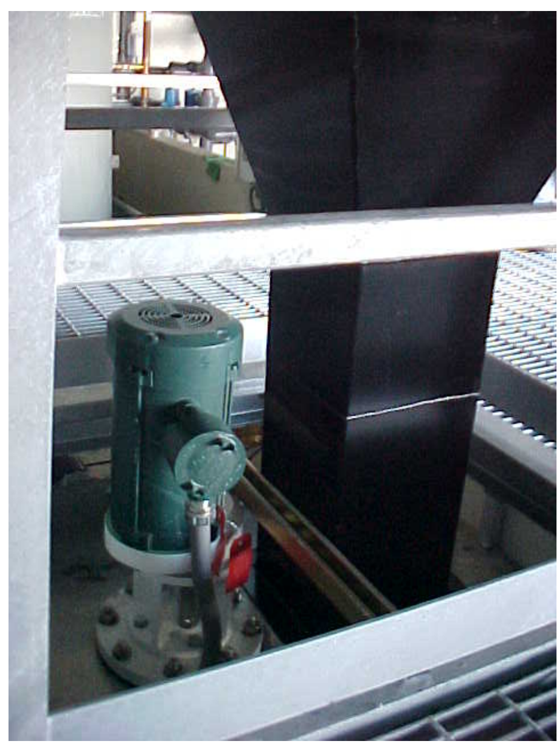


Figure 5-3. Special duct and mixer.

Each tank also had 5 penetrations on the side of the tank. A 2-inch port was supplied for fresh water addition, a 3-inch port for exhaust gas was piped to the bioreactor, two 2-inch ports were added for discharging and recycling contents, and a ¾-inch port was provided for the pressure sensor.

Each tank was outfitted with a mixer from Sharpe Mixers of Palm Desert, CA, Model FGV-200. They are fitted with single-reduction, helical gear drives and rated at 4.8 horsepower. The shaft is 1.25 inches in diameter and 36 inches long from the mounting base with a 6-inch impeller.

<u>Mixing Tank Pumps</u>

A 15 – 20 gal/min pump is plumbed to each mixing tank to recycle the contents during the mixing and emulsification stage of the process as well as for transferring the contents from the mixing tank to the reactor tanks. The mixing tank pump (figure 5-4) is a Gould pump, G&L series, Model NPO, closed coupled pump with a 1-hp motor.

Figure 5-4. Mixing tank pump.

Reactor Tanks

Each stainless steel reactor tank (figure 5-5) is 7-feet 6-inches in diameter by 14 feet tall and is equipped with 8 penetrations on the side and 7 penetrations on top. The total capacity of the tank is 4627 gallons with a working capacity of 4330 gallons. Penetrations on the side of the tank consist of: 1) One 36-inch manhole; 2) five 2.5-inch ports welded with Victaulic nipples and retrofitted with air-actuated valves and sampling ports, with one located at the bottom of the tank, one at the center of the tank, one at 2 feet above center, one at 4 feet above center, and a third at 6 feet above center, used to recycle and empty the tank at various stages of treatment; 3) a ¾-inch port welded with a normal pipe thread (NPT) nipple 36 inches from the bottom used for the pH adjustment loop that housed the pH probe and the injection ports for acid and base addition; and 4) a ¾-inch port welded with an NPT nipple located at the bottom of the tank used for a pressure sensor and sample port. Penetrations on top of the tank consist of: 1) four 2-inch ports welded with Victaulic nipples used for fresh water addition, nutrient addition, humidifier water addition, and housing an oxygen sensor; 2) a 4-inch port with a welded 150-lb flange for supporting a mixer; 3) a 10-inch-long by 10-inch-wide hole for access; and 4) a 3-inch port welded with a Victaulic nipple that was used as the air header.

Figure 5-5. Reactor tank.

The air distribution piping system consists of 3-inch stainless steel pipe, running the height of the tank and connecting to a manifold located at the bottom of the tank (figure 5-6). The manifold is a 3-inch stainless steel pipe, running from one end of the reactor tank to the other side. This pipe has 8 additional 2-inch stainless steel pipes welded to it to form a network. The 2-inch stainless steel pipes were drilled with holes on the underside for aeration.


Figure 5-6. Aeration system at the bottom of the reactor tank.

Each tank is outfitted with a mixer from Sharpe Mixers of Palm Desert, CA, Model FGV-200. They are fitted with single-reduction, helical gear drives and rated at 4.8 horsepower. The shaft is 1.25 inches in diameter and 36 inches long from the mounting base with an 11-inch impeller.

Reactor Tank Pumps

A 125-gal/min pump is plumbed to each tank to recycle the contents during the treatment process and for transferring the contents after the treatment has been completed. The reactor tank pump (figure 5-7) is a Gould pump, G&L series, Model SSH-C, closed coupled pump with a 5-hp motor.

Reactor Tank Blowers

A blower (figure 5-8) is plumbed to the reactor tank to provide oxygen to the reactor contents. The blower used is a Fuji Electric Corporation of America blower type CE, HP Regenerative Blower equipped with a 6.5-hp motor. The maximum pressure for the blower is 7.3 psig, maximum vacuum is 11.3 inches of mercury, and maximum flow is 160 standard cubic feet per minute.

Figure 5-7. Reactor tank recirculation/transfer pump.

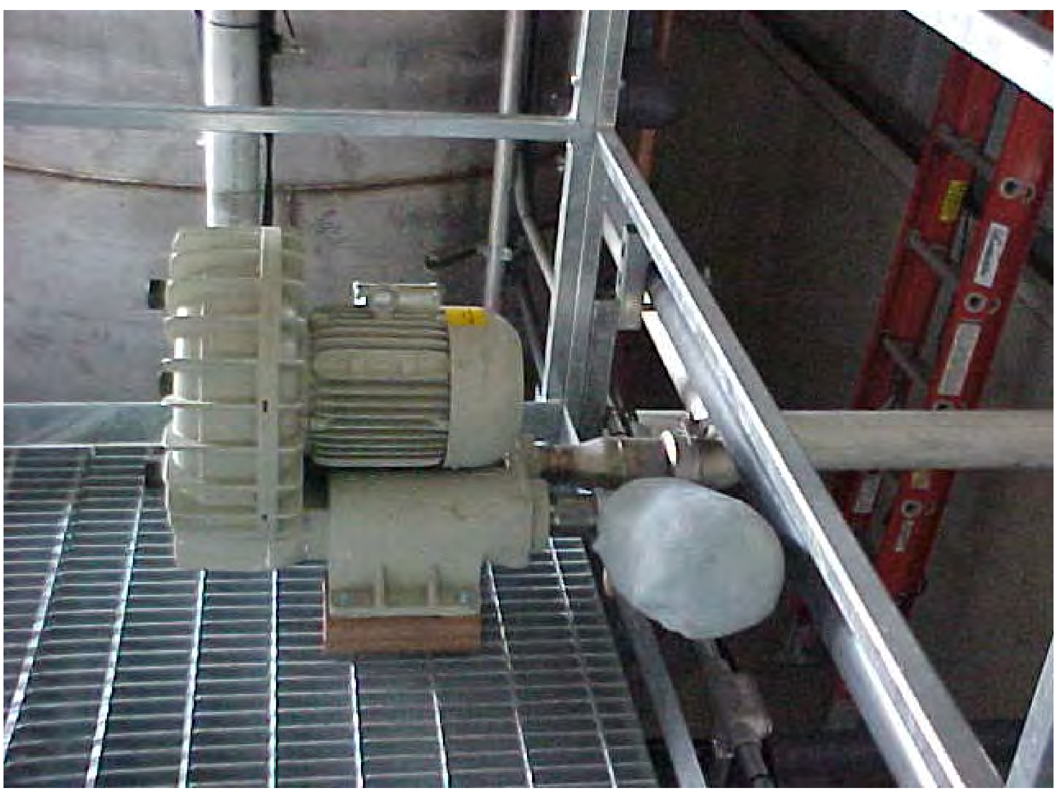


Figure 5-8. Blower.

pH Control Systems

The pH control system (Figure 5-9) consists of 2 LMI metering pumps (Model AA961-3C2SP) with capacities each of 2 gallons per hour. An ABB pH controller (Model AX400) and ABB pH sensor (Model TB(X)551) is used to control the 2 pumps in order to maintain an optimal pH. Two 1-gallon containers with secondary containment hold the acid and base for the metering pumps. The acid and base used during the demonstration was sulfuric acid and sodium hydroxide, respectively.

Figure 5-9. pH control system.

Nutrient System

The nutrient system (Figure 5-10) consists of a 100-gallon polyethylene tank, a Dayton mixer with a ¼-hp motor, and a Gould’s pump, G&L series, 10 gallons per minute, with a ¾-hp motor. Nutrients are mixed for 2 minutes in the tank prior to addition and then added, using the programmable logic controller (PLC).

Figure 5-10. Nutrient addition system.

Platforms

Each treatment train was outfitted with a galvanized steel, 13-foot long by 9-foot wide by 4.5-foot high platform (figure 5-11). Each platform has a railing and a ladder. The platform serves 2 functions: 1) elevate the can crusher above the mixing tank; and 2) provide space for staging paint for processing.

System Motor Control Panel

The system motor control panel (figure 5-12) consists of a NEMA 4X panel used to house all of the motor starters, variable speed drives (Danfoss), circuit breakers, relays, programmable logic controller (Allen Bradley Micro Logix 1500), panel view (Allen Bradley Panel View 550), dissolved oxygen analyzer (Insite IG Model 1000), and ancillary equipment. The PLC is used to automate the system for ease of operation.

Figure 5-11. View of platform and ladder with installed can crusher.

Figure 5-12. Motor control panel.

Biofilter System

The modular-packaged biofilters are Biocube™ (Model PP-600) for VOC control from BIOREM, Inc. (figure 5-13). The Biocube™ is a modular biofilter formed by stacking several interlocking trays filled with Biorem's proprietary, biological, VOC-metabolizing media. Each Biocube™ consists of 5 media-filled trays with 1 empty inverted tray for a lid. It does not require regular addition of chemicals or nutrients. The process required 4 Biocubes™ working in parallel to be installed--each column is 6 feet in diameter and 85 inches tall, and each tray has 12 inches of media, totaling 400 cubic feet of media. A 'Moisture Integrator Bubbler', or humidifier was installed to provide optimum biological moisture content and temperature for the process. The system adds moisture to the air stream as it enters the biofilters and removes moisture before the air stream enters the GAC filter. VOC-concentrated waste streams tend to dry out the media and this helps to compensate. Other parts included in the system are: a centrifugal blower, activated carbon tank, motor control panel, wiring, and piping. Residence time for the system was 40 seconds and overall air capacity is 500 cubic feet per minute (CFM).

Figure 5-13. Biofilter system.

Humidifier Water Transfer System

On a PLC-controlled basis, the humidifier routinely discharges waters from its reservoirs and replenishes with fresh new water. On average, 15 to 25 gallons of water per day is removed from the humidifier and transferred to the humidifier water transfer system's holding tank. When this tank fills, the water is pumped to temporary storage tanks. This water is reprocessed through the system to ensure that water being discharged to the sewer meets organic requirements. WasTech Engineering fabricated the humidifier water transfer system (figure 5-14). The system consists of a 4-feet-long by 4-feet-wide by 1-foot-high tank retrofitted with a

submergible pump (Filter Pump Industries, Model P-1/6 A, 5 gallons per minute), level sensor high high, level sensor low, and a level sensor low low. The system was also supplied with a control panel with an off and on switch, and manual and auto operation selector switch.

Figure 5-14. Humidifier water transfer system.

Humidifier Water Tanks

Two humidifier water tanks are supplied to temporarily store humidifier water prior to transferring to Bioreactor A. The two 6-feet-long by 3-feet-wide by 4-feet-high polyethylene tanks are plumbed together in order to double the storage capacity. One of the tanks is retrofitted with a little giant submersible pump for transferring the contents to Bioreactor A.

5.3.2 Operation

Based on the pilot study, two-part solvent-based paints in table 2-1 should have been used. However, most of the paint supplied was solvent-based enamel with one batch being epoxy paint and another of various paints with most consisting of silicone-based paints. For this demonstration and evaluation, results from test runs 2 through 5 will be used because these paints most resemble those initially targeted. Test run 1 served as an acclimation period. Therefore, the analytical results will not be considered. Also not considered are the analytical results from test run 6 which encompassed treating silicone-based paints. Anticorrosion paints, latex, and oil-based paints (MIL-PRF-24635) were not included in the pilot study, nor were they included here.

Accumulated paint at the 90-day site was delivered to the IWTC as necessary. Table 5-1 shows the types and makeup of paints that were delivered and used for the demonstration and evaluation. This information was gleamed from the material safety data sheets provided by the activity at the time the paint was delivered. Many manufacturers were contacted in the past for additional information regarding the specific formulations of their manufactured paints. Most, if not all, manufacturers refused to divulge this information to the Navy without some sort of documentation ensuring secrecy of the information provided. For this reason no additional efforts were taken to acquire more specific paint data.

As shown in table 5-1, all paints but two contained mineral spirits, which is a petroleum distillate and not a neat solvent. In addition, hydrocarbon mixtures, aromatic hydrocarbon, and Medium Aliphatic Solvent Naphtha are descriptors used by the manufactures to describe the various organics found in the paints supplied that are not very specific to one or more specific organic(s). For these reasons, it was very difficult, if not impossible, to follow the degradation rates of the specific organic constituents found in the paints treated.

Table 5-1. Paint manufacturer and paint makeup.

Name	Item Name	Compounds	Percent
Dalvin Paint Co, Inc.	Enamel	Hydrocarbon Mixture	25
Parker Paint	Enamel	Aromatic Hydrocarbon	14
		Mineral Spirits	10
		Naphtha	10
		Ethyl Benzene	0.21
		Xylene	1.0
Sherwin Williams Co	Enamel	Mineral Spirits	49
Light Gray		Ethylbenzene	0.2
		Cobalt 2-Ethylhexonate	0.1
		Titanium Dioxide	8
		Carbon Black	0.3
Del Paint Corp.	Enamel	Medium Aliphatic Solvent Naphtha	31.5
		Non-hazardous Ingredients	68
Parker Paints	Enamel	Mineral Spirits	17
		Naphtha	7
		Aromatic Hydrocarbons	3
		1,2,4 Trimethylbenzene	0.20
		Ethylbenzene	0.08

Table 5-1. Paint manufacturer and paint makeup - Continued.

Name	Item Name	Compounds	Percent
Sherwin Williams Co	Epoxy-Polyamide	1-Butanol	22
	Component A	Phenylmethanol	8
		Propriety Polyamide	22
		Tac	35
		Titanium Dioxide	10

After installation was completed, the systems were tested with water to ensure that all systems were working properly and to ensure that there were no leaks. System B was then started up and loaded with 25 gallons of paint for Run 1, an acclimating phase. Based on the pilot study results, all additions to the system for Run 1 are listed in table 5-2. After Run 1, the parameters were changed accordingly to ensure that the ratios of nutrients were consistent with the pilot test. Unfortunately, there was no time to research the optimum nutrient ratios and table 5-3 lists the paint and nutrient loadings for Runs 2 through 5.

Table 5-2. Initial DEM/VAL system additions based on pilot study results (Test Run 1).

Parameter	Value
Paint	25 gallons
Water	4,375 gallons
Nitrogen (as Urea)	8.6 lbs
Phosphorus (as phosphate)	41.6 lbs
Yeast extract	7.5 lbs
Casein (N-Z Amine)	9 lbs
Air flow	250 cfm

Table 5.3. Additions made to the system for test runs 2 – 5.

Test Run	Paint (gallons)	Water (gallons)	Phosphorus (lbs)	Nitrogen (lbs)	Yeast (lbs)	N-amine (lbs)
2	40	4,375	4.1	1.7	7.5	9
3	60	4,375	24.2	10.1	7.5	9
4	64	4,375	7.9	38.9	9	7.5
5	36	4,375	8.4	41.5	9	7.5

<u>System Operation</u>

There is a main circuit breaker (100-amp service) that powers all of the motor control panels on both bioreactor systems (A&B), including the biofilter and humidifier transfer tank systems. Bioreactor system A and B both have dedicated motor control panels that also energize the pH control systems' metering pumps and pH controllers. Once all of the motor control panels are energized the system is ready to be operated.

Each bioreactor system (which consists of a reactor, can crusher, mixing tank, blower, 3 pumps, 2 mixers, pH control system, and nutrient addition system) is control by a programmable logic controller (PLC) located in each motor control panel. A program was developed and downloaded to the PLCs to assist operators through the operations of the bioreactor systems. The PLCs control all of the pumps, mixers, and blower motors, as well as the air-actuated valves, can crushers, and nutrient addition systems for the respective system. Although the PLCs are not used to control pH, they do control the power to the pH control systems. The PLCs sequence the equipment (i.e., can crushers, blowers, mixers, valves, etc.) as one proceeds through the different stages of the process. However, before initiating the systems, the nutrient addition system tanks must be loaded with premeasured nitrogen, phosphorus, yeast extract, bone meal, and 80 gallons of water. The acid and base containers should also be filled with sulfuric acid and sodium hydroxide, respectively, before starting the system(s). It should be noted that the biofilter system must be energized before the bioreactor system can be operated.

There is one biofilter system that services both bioreactor systems. All of the air streams generated by both bioreactor systems are piped together and eventually sucked by the biofilter blower through the humidifier, biofilters, dehumidifier, and activated carbon bed before being released to the atmosphere. The motor control panel for this system also has a PLC that controls the function of the system. Valves located at the exhaust of the bioreactor systems' can crusher blowers are used to isolate air streams when one system is not being operated. This eliminates the possibility of allowing untreated gases from entering the atmosphere. Prior to starting the biofilter system, these valves must be in the proper open/close configuration.

The biofilter system's humidifier occasionally discharges water from its reservoirs to ensure that microbial growth does not take place and foul the controls. This water is gravity fed to a humidifier water transfer system tank. The humidifier water transfer system consists of a small tank, pump, level controls, and a motor control panel. After the system is put on "auto" mode, level sensors energize the pump and transfer the contents to the humidifier water tanks.

After all of the motor control panels are energized and the air valves are configured correctly, the bioreactor system(s) are ready for operation. Each bioreactor system's motor control panel is also equipped with a panel view for accessing and communicating with the program. When the system motor control panel is powered, the PLC initiates the program and instructions to proceed can be found on the panel view. The first thing the program will ask is if water in the humidifier water tank needs to be transferred. If the reply is yes (by pushing the yes button on the screen), then the system will energize the submersible pump in the humidifier water tank and initiate water transfer to reactor A. After the tank is emptied, press the "complete" button and the PLC will de-energize the submersible pump. To proceed, push the "continue" button at the bottom left of the pane view.

The next question posted is "Ready to load the reactor?" If the "yes" button is pressed, the system will initialize itself. A yellow light will illuminate, and the mixing and reactor tanks will fill half way. When this has been accomplished, the mixing tank, reactor tank pumps, and mixing tank mixer will turn on, as well as the main blower and can crusher blower. The yellow light no longer illuminates and a green light will indicate it is OK to continue. Throughout the process, a yellow light indicates the system is executing something and the green light means that the system has completed a step and is waiting for the operator to continue with the process.

After the system has completed the initializing phase and the green light illuminates, the "continue" button should be pressed to proceed. The next question asked is "Paint ready to be loaded?" If the "yes" button is pushed, the can crusher is energized and the system is ready to accept paint. It should be noted there are 4 loading cycles. The total number of cans to be crushed should be divided by 4, giving the number of cans to crush during each loading cycle. After each crushing cycle, water is added to the mixing tank to a preprogrammed level and allowed to mix and stir for 2 minutes. When the 2 minutes have expired the contents are transferred to the reactor tank, which is half full of water. After this has occurred, the green light is illuminated and the operator is required to press the "continue" button. By pressing the "continue" button the program proceeds and asks "Paint ready to be loaded?" The "yes" button is pressed until this cycle is exercised 4 times or all the cans have been crushed. If the loading cycle is exercised 4 times or the "no" button is pressed, the program will automatically proceed to the flushing process and ask "Would you like to flush the tank?" By pressing the "yes" button, the mixing tank is flushed (filled with water) 3 times and discharged to the reactor before the next stage is initiated.

As the can crusher crushes the paint cans, the contents of the cans are allowed to fall into the mixing tank. In the mixing tank, the liquor is allowed to recycle in order for the paint and water to be emulsified. Approximately 280 gallons of liquor are transferred to the reactor tank during 1 loading operation. In addition, the resulting crushed can (coined "puck") is automatically discarded into a 55-gallon drum for final disposal.

During the paint-loading stage, the reactor is filled with a water/paint emulsion causing the level in the reactor tank to rise. As the level rises in the reactor tank, the liquor, subsequently, submerges the 4 discharge ports located at the side of the tank. These 4 discharge ports are separated by 24 inches and retrofitted with pneumatic valves. As the liquor level rises and reaches 12 inches above the first discharge port, that respective pneumatic valve opens. As the liquor level continues to rise and eventually reaches 12 inches above the second port, that port's pneumatic valve opens and the first port's pneumatic valve closes. This sequencing of valves continues until the level rises 12 inches above the last port at which time all of the pneumatic valves are eventually closed with the exception of the last one. This sequencing of valves ensures that the liquor is always pumped from the top of the tank to the extent possible. The discharge side of the pump is piped to a port 3 feet above the bottom of the tank and the retrofitted pneumatic valve remains open during loading and processing.

After flushing of the mixing tank has been completed, the green light illuminates and the operator is required to press the "continue" button. The operator is then asked "Nutrients ready to be transferred?" Pressing the "yes" button initiates the nutrient transfer stage. The yellow light illuminates and the nutrient tank mixer is energized. After 2 minutes of mixing, the pump is energized and the contents are transferred to the reactor tank. After the nutrients have been transferred, the yellow light quits illuminating and the green light illuminates requiring the operator to press the "continue" button.

When the "continue" button is pressed, the next question asked is "System ready to process?" By pressing the "yes" button, the yellow light illuminates and the reactor is filled to the preprogrammed operating level. After the operating level is reached, the reactor tank mixer is energized and treatment is initiated. The green light illuminates indicating system processing,

and a timer starts tracking processing time. The pH control system automatically ensures that the pH is kept near neutral between 6.5 and 7.5 during the entire processing stage. At the end of the treatment cycle (which is predetermined by the operator and 10 days for this DEM/VAL) the operator presses the "finish" button, which illuminates the yellow light, and the system automatically transfers half the contents in the reactor tank to a receiving tank for further settling and testing. After this has occurred, the program goes back to the beginning and the green light illuminates, indicating it is ready to process paint once again.

A total of 5 test runs were conducted, consisting of loading the system with 5 different batches of paint. The quantity of paint and nutrients used for each test run can be found in tables 5-2 and 5-3. After the reactor was loaded with paint and nutrients, it was allowed to process paint for a period of 2 weeks. During the processing period, 3 samples were collected for each test run. One sample was collected at the beginning of the cycle, another after approximately 7 days, and a third approximately 14 days after processing. Samples collected consisted of water and exhaust gas. The exhaust gas samples consisted of pre-biofilter, post-biofilter, and post-activated carbon.

5.3.3 Laboratory Analyses

Extensive laboratory analyses were conducted to determine if the process was meeting regulatory requirements for air and water phases; to characterize by-products for hazardous waste determination; and to determine the economic feasibility of the process. Sampling procedures and test methods are further described below by phase. Water analyses were conducted by COMNAV's environmental lab, Columbia Analytical Services of Kelso, Washington, and NAVFAC ESC. Solid phase analyses were conducted by Columbia Analytical Services, and microbial population analyses were contracted to Microbial Insights, Inc. of Rockford, Tennessee. Gas phase tests were done by Columbia Analytical Services of Simi Valley, California.

5.3.3.1 Water phase. Three samples per test run were collected in pre-conditioned bottles. Sample port associated with valveYV-202 was used (figure 2-3), where a homogenous, well-mixed sample could be obtained. The constituents tested, their extraction method, the testing method, and the bottle required is listed in table 5-4.

In addition to the tests listed in table 5-3, FTIR spectroscopy analysis was completed on the liquid phase. Sample port was the same and the bottle required was a 2-oz clear glass jar with 10 percent headspace. FTIR spectroscopy, the study of the interaction of infrared radiation with the chemical bonds found in materials, is completed by applying infrared radiation to a substance and measuring the subsequent absorbance and converting the measurements to a spectrum using a computer. FTIR is capable of analyzing a vast array of materials in solid, liquid, and gaseous forms. The analysis was selected for determining the biodegradation of paints because of its ability to detect organic (and many inorganic) compounds and functional groups. Additionally, the changes in the chemical nature of the compounds during degradation can be revealed. For the DEM/VAL project, FTIR analyses was employed for both liquid and sludge paint samples.

Table 5-4. Constituents tested and their methods used for laboratory analysis on the water phase.

Constituent	Method	Extraction method	Bottle
Ammonia as Nitrogen	350.1	None	1 L clear H_2SO_4
Biological Oxygen Demand (BOD)	SM 5210 B	None	1 L clear (unpreserved)
Total Organic Carbon (TOC)	ASTM D4129-82M	None	1 L clear H_2SO_4
Chemical Oxygen Demand (COD)	SM 5220 C	None	1 L clear H_2SO_4
Total Residual Chlorine	SM 4500-ClF	None	1 L clear (unpreserved)
Hexavalent Chromium (Cr^{6+})	7196A	None	500 mL plastic clear (unpreserved)
Nitrate+Nitrite as Nitrogen	353.2	None	1 L clear H_2SO_4
Total Kjeldahl Nitrogen (TKN)	ASTM D1426-93B	ASTM D3590-89B-21.1	1 L clear H_2SO_4
Orthophosphate as Phosphorus	365.3	None	500 mL plastic clear (unpreserved)
Sulfate	300	None	500 mL plastic clear (unpreserved)
pH	SM 4500-H+B	None	1 L clear (unpreserved)
Settleable Solids	SM 2540 F	None	1 L clear (unpreserved)
Total Suspended Solids	SM 2540 D	None	1 L clear (unpreserved)
Total Volatile Solids	160.4	None	1 L clear (unpreserved)
Metals	6010B	CLAA	500 mL plastic clear HNO_3
Mercury	7471A	None	500 mL plastic clear HNO_3
Volatile Organic Compounds (VOC's)	8260B	EPA 5030B	2 oz glass jar with clear teflon liner
Semi-volatile Organic Compounds (SVOC's)	8270C	EPA 3520 C	1 L amber (unpreserved)

5.3.3.2 Solid phase. Three sludge samples were extracted at the end of the project from the bottom of the tank after the water phase had been decanted. In addition to the FTIR analysis (as described above), Toxicity Characteristic Leaching Procedure (TCLP) for metals and organics, total metals, TOC, and solids were all conducted. Samples were collected in simple clear plastic jars and tested according to the methods listed in table 5-5.

Table 5-5. Constituents tested and their methods used for laboratory analysis on the solids phase.

Constituent	Method	Extraction Method	Bottle
Total Solids	160.3	None	N/A
TOC	9060M	CAS SOP	N/A
Arsenic	6020	EPA 3050B	N/A
Barium	6010B	EPA 3050B	N/A
Beryllium	6020	EPA 3050B	N/A
Cadmium	6020	EPA 3050B	N/A
Chromium	6010B	EPA 3050B	N/A
Copper	6010B	EPA 3050B	N/A
Lead	6020	EPA 3050B	N/A
Manganese	6010B	EPA 3050B	N/A
Mercury	7471A	None	N/A
Nickel	6020	EPA 3050B	N/A
Selenium	6020	EPA 3050B	N/A
Silver	6020	EPA 3050B	N/A
Tin	6010B	EPA 3050B	N/A
Titanium	6010B	EPA 3050B	N/A
Zinc	6010B	EPA 3050B	N/A

TCLP is designed to determine the mobility of both organic and inorganic compounds present in the media of concern. It is typically used to determine if a waste meets the definition of EPA Toxicity (i.e., carrying a hazardous waste code under RCRA (40 CFR Part 261) of D004 through D052). If the waste fails the test for one or more of the tested compounds, it is considered to be hazardous waste.

5.3.3.3 Gas phase. Gas was collected via sample ports prior to the biofilters (aerobic digestor and can crusher exhaust), directly after the biofilters (biofilter exhaust), and after the activated carbon filter (final exhaust). Gas was captured using pressurized 1.0 liter Summa Canisters and analyzed for VOCs and tentatively identified compounds (TICs). Method for testing was EPA Method TO-15 from the "Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air," second edition (January 1999), (EPA/625/R-96/0101b). Analysis

was conducted using a gas chromatograph/mass spectrometer (GC/MS) that was interfaced to a whole-air pre-concentrator. Table 5-6 lists the VOCs predetermined for testing based upon solvent-based paint makeup.

Table 5-6. Predetermined VOCs tested during the DEM/VAL.

VOC's	
Propene	d-Limonene
Dichlorodifluoromethane (CFC 12)	1,2-Dibromo-3-chloropropane
Chloromethane	1,2,4-Trichlorobenzene
1,2-Dichloro-1,1,2,2-tetrafluoroethane (CFC 114)	Naphthalene
Vinyl Chloride	Hexachlorobutadiene
1,3-Butadiene	Tetrachloroethene
Bromomethane	Chlorobenzene
Chloroethane	Ethylbenzene
Ethanol	m,p-Xylenes
Acetonitrile	Bromoform
Acrolein	Styrene
Acetone	o-Xylene
Trichlorofluoromethane	n-Nonane
2-Propanol (Isopropyl Alcohol)	1,1,2,2-Tetrachloroethane
Acrylonitrile	Cumene
1,1-Dichloroethene	alpha-Pinene
Methylene Chloride	n-Propylbenzene
3-Chloro-1-propene (Allyl Chloride)	4-Ethyltoluene
Trichlorotrifluoroethane	1,3,5-Trimethylbenzene
Carbon Disulfide	1,2,4-Trimethylbenzene
trans-1,2-Dichloroethene	Benzyl Chloride
1,1-Dichloroethane	1,3-Dichlorobenzene
Methyl tert-Butyl Ether	1,4-Dichlorobenzene
Vinyl Acetate	1,2-Dichlorobenzene
2-Butanone (MEK)	n-Butyl Acetate
cis-1,2-Dichloroethene	n-Octane
Ethyl Acetate	Trichloroethene
n-Hexane	1,4-Dioxane
Chloroform	Methyl Methacrylate
Tetrahydrofuran (THF)	n-Heptane
1,2-Dichloroethane	cis-1,3-Dichloropropene
1,1,1-Trichloroethane	4-Methyl-2-pentanone

Table 5-6. Predetermined VOCs tested during the DEM/VAL - Continued.

VOC's – Continued	
Benzene	trans-1,3-Dichloropropene
Carbon Tetrachloride	1,1,2-Trichloroethane
Cyclohexane	Toluene
1,2-Dichloropropane	2-Hexanone
Bromodichloromethane	Dibromochloromethane
1,2-Dibromoethane	

6.0 PERFORMANCE ASSESSMENT

6.1 BENCH SCALE

As described in Section 2.2.2, NAVFAC ESC conducted bench scale feasibility testing of solvent-based paint. Full descriptions and results can be found in the TM-2368-ENV (2004) [3].

Samples were taken from test flasks at regular intervals, and the optical density at 520 nm was measured as an indicator of bacterial growth. If the bacteria are using the organic components in the paint as a food and energy source, then the optical density, which is proportional to the number of bacteria, will increase until some limit is reached. Samples were also extracted with hexane, filtered with 0.2-µm nylon filter and analyzed using gas chromatography and FTIR. These analyses will show peak disappearance with degradation.

Bacterial growth on base and activator supplemented medium is shown in figure 6-1. While both components supported significant growth, growth is slower on the activator. The explanation reported was that one or more of the compounds were toxic or the bacteria were not well enough adapted to these compounds. However, the spectra (figures 6-2 through 6-4) demonstrated changes consistent with biodegradation, and conclusions were drawn from this that degradation occurred. Comparing figures 6-2 and 6-4 shows that adsorption bands characteristic of the activator (e.g., the broad band at 2000 – 2500 cm-1 found only in the activator) are completely absent after 2 weeks of bacterial growth. Peaks in the spectrum of the base (figure 6-3) show absorption bands at 3,500 cm-1 (C-O), 2,700 cm-1 (C-H), and 1,700 cm-1 (C=O and C=C) characteristic of the polyester backbone (figure 6-4). The spectrum of the degraded resin (figure 6-4) lacks all of these peaks.

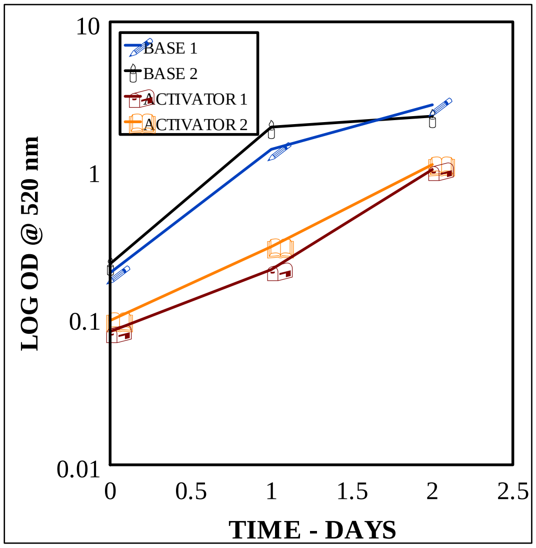


Figure 6-1. Growth of duplicate cultures derived from oily sludge degrading microbial consortia on polyurethane base and activator.

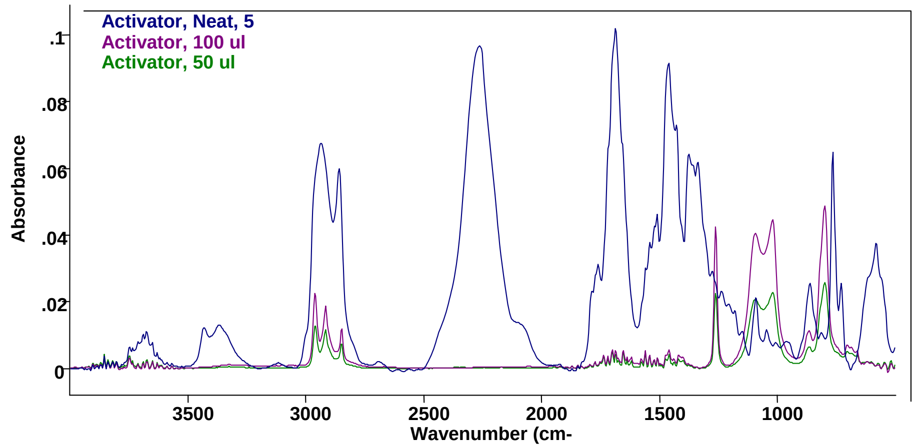


Figure 6-2. FTIR spectrum of polyurethane activator and hexane extracts of 2-week cultures.

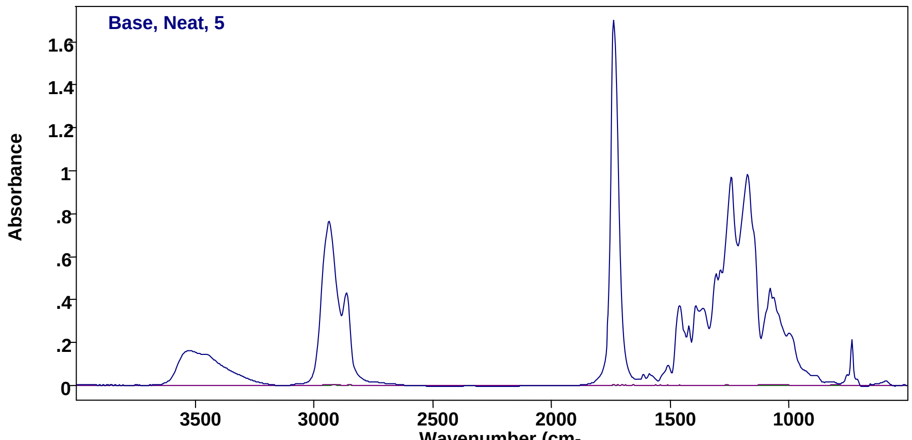


Figure 6-3. FTIR spectrum of polyeretane resin applied to a potassium bromide window and dried in a desiccator prior to running the spectrum.

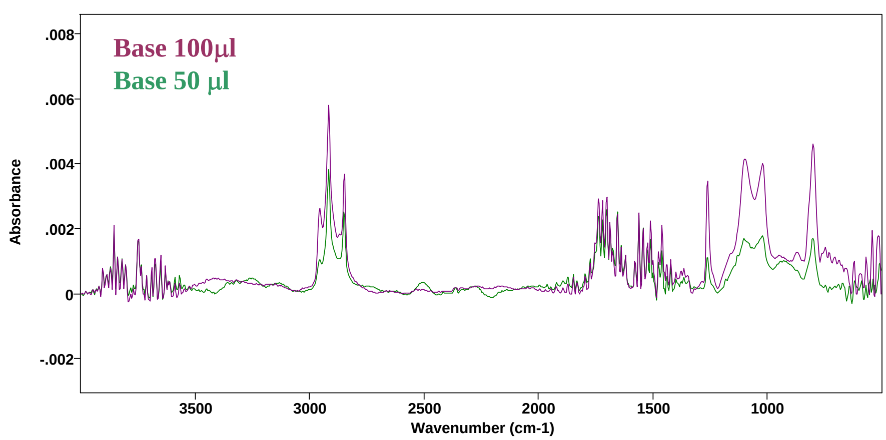


Figure 6-4. FTIR spectrum of hexane extracts of base fed cultures after 2 weeks of growth.

6.2 PILOT-SCALE

As described in Section 2.2.3, NAVFAC ESC conducted a pilot study of aerobic digestion for solvent-based paint in Pearl Harbor, HI. Full details and results of this project can be found in TM-XXXX-ENV (2005) [17].

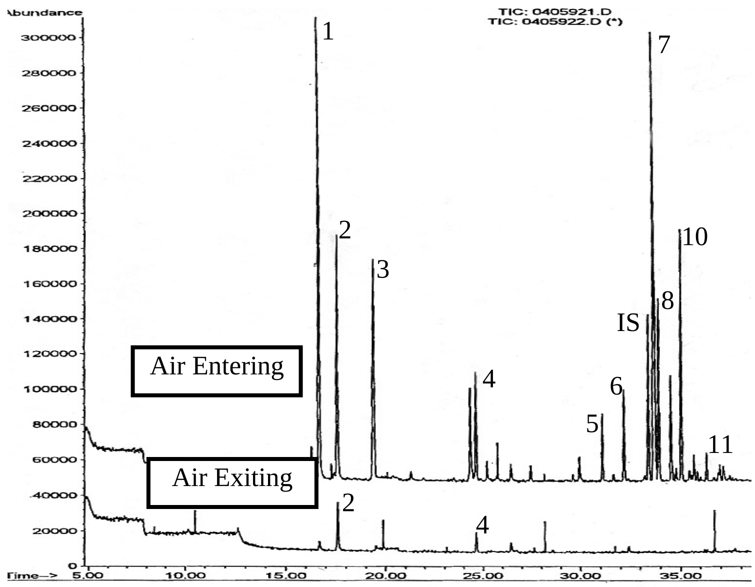
Testing on the water phase for the pilot study was limited to FTIR analysis and the COMNAV regulations. No TTO analysis was completed. Testing on the air phase was limited to FTIR analysis on a small number of VOC compounds. Summarized results of the pilot study are shown in table 6-1 and figures 6-5 and 6-6. Figure 6-5 shows degradation results in the reactors and table 6-1 and figure 6-6 detail degradation of compounds through the biofilters.

Table 6-1. Specific organic compounds tested in air and their respective percent removal.

Peak #	Compound	Percent Removal
1	Methyl Amyl Ketone	>95
2	Tetrahydrofuran	70
3	Methyl Isoamyl Ketone	>95
4	4-Methyl-2-Pentanone	70
5	1-Methylethyhl Benzene	>95
6	Propylbenzene	>95
7	1-Ethyl-3-Methyl Benzene	>95
8	1,3,5-Triethyl Benzene	>95
9	1-Ethyl-2-MethylBenzene	>95
10	1,2,4-Trimethyl Benzene	>95
11	1,2,3-Triethyl Benzene	>95
IS	Internal Standard	N/A

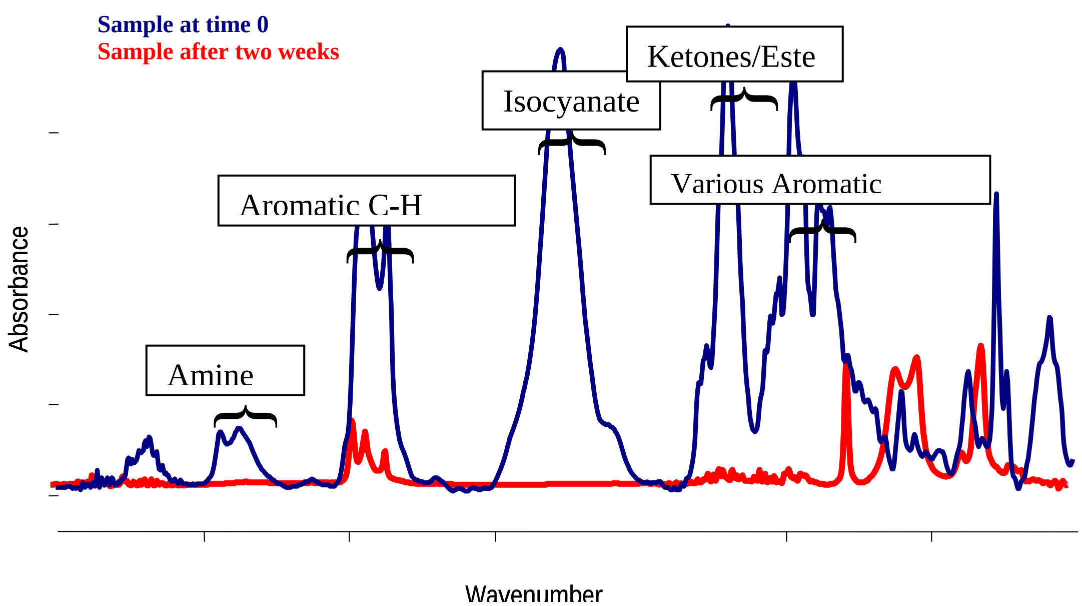
Through an FTIR analysis of the polyester resin, figure 6-5 depicts graphically the disappearance of the aromatic C-H bond after two weeks, possibly indicating that the aromatic ring was degraded. In the air, reductions of greater than 95 percent in most of the VOCs tested through the biofilters were seen. Table 6-1 lists the specific compounds tested and their respective degradation percentages and figure 6-6 shows these results graphically.

To determine if the water phase from the treatment process met the COMNAV Pearl Harbor Base Limits for discharges of treated water from the IWTC to the sanitary sewer, approximately 500 gallons of wastewater from the reactors was accumulated on site and analyzed for



Gas Chromatogram of air entering and exiting the biofilters. The identity of the numbered peaks is shown in table 6-1.

Figure 6-5. FTIR graph of water tested from the pilot scale reactor.



Fourier transform infrared (FTIR) spectra of fresh polyurethane resin (time 0) and after two weeks of degradation. Absorption bands characteristic of the resin are annotated on the spectra.

Figure 6-6. Gas chromatogram graphically depicting degradation of VOCs through the biofilters.

constituents specified in the COMNAV Base limits. These results are shown in table 6-2 along with the COMNAV Base regulations. The results show that the wastewater discharged from the reactors, following biological treatment of ESL paint, meets requirements for discharge to the NPDES-regulated treatment plant. Sulfide is the only regulated constituent that was elevated. It was surmised that because the tank used to accumulate the effluent was not mixed, it became anaerobic, allowing sulfide production. Under normal operations, this would not occur.

Solids accumulated in the reactors were sampled and analyzed for total metals. The report states that the solids had levels of priority metals below the total threshold limit concentrations (TTLC) and Soluble Threshold Limit Concentration (STLC) for landfill disposal. The concentrations of most of the metals were also below the Practical Quantization Limit (0.005 – 0.7 mg/L).

Table 6-2. COMNAV Pearl Harbor base limits for discharges and sample results.

Parameter	COMNAV Base Limit (mg/L)	Sample Results (mg/L)
Ag	0.43	<0.030
As	0.50	<0.130
Ba	50.00	0.01
Be	0.20	<0.010
Cd	0.69	<0.010
Cr	2.77	<0.087
Cr6+	0.50	0.11
Cu	3.38	1.48
Hg	0.05	0.00
Mn	N/A	N/A
Ni	3.98	0.23
Pb	0.69	0.06
Se	0.90	<0.12
Sn	10.00	<0.050
Ti	0.50	<0.080
Zn	2.61	0.22
pH range	5.5 - 9.5	7.20
Total Cyanide	1.20	N/A
Sulfide	5.00	5.00
TOC	1200.00	423.00
TPH	25.00	<5.00
Oil and Grease	160.00	N/A
Nitrites	5.00	N/A
Hydrazine	5.00	N/A
Peroxide	5.00	N/A
Chlorine	50.00	N/A
TSS	600.00	300.00
MBAS	30.00	N/A

6.3 FULL-SCALE DEMONSTRATION/VALIDATION RESULTS

The data results for the DEM/VAL project are extensive. All data can be reviewed in the appendices. Full-profile analyses were conducted on Runs 2 through 6. Results of the analyses on Runs 2 through 5 are analyzed for this report and used for cost calculations, while Runs 1 and 6 were excluded. Because Run 1 was a startup phase and was used as a time period for acclimating the biomass and establishing paint-degrading specific bacteria, the results are not conclusive for the results analysis. A silicone-based paint was received and utilized for Run 6. However, the sludge from this test run was never analyzed due to lack of funds. Therefore, it was decided not to include these results as well. Sample results for these test runs can be reviewed in the appendices. For this section, the results based on Section 3.0's Performance Objectives are listed in order. At the end of each section, any additional comparisons demonstrating the system's successes and failures are shown.

6.3.1 Quantitative Performance Objectives

6.3.1.1 Aerobic digestion of ESL paint. Under the pilot study, it was deduced that a residence time of 8-10 days would be both physically and economically feasible. However, the DEM/VAL results showed two major issues with this constraint. First, an optimal environment was never actually reached during the DEM/VAL phase because of the inability to shear and emulsify the paint to a degree that made the organics available to the microbes for degradation and the infrequent loading of the bioreactor due to site constraints. Therefore, full digestion never occurred and an established residence time was never achieved. Second, even if degradation was successful in 8-10 days, based on the amount of paint throughput, the system would not be cost effective. Table 6-3 summarizes the paint throughput and associated cost comparison based upon the following: DEM/VAL VOC biofiltration data, 1.395 percent liquor, run time of 4 days, and running the system every week of the year. Current disposal cost for hazardous waste through DRMO is $9.19 per gallon of paint. Because the biofilters never reached maturity, their theoretical removal efficiency could not be achieved. Therefore GAC usage costs were elevated. Table 6-4 uses the same numbers for the cost comparison, except that the paint treatment cost is based on a 90 percent VOC removal efficiency of the biofilters. The full economic analysis is detailed in Section 7.0.

Another way to address the success of the aerobic digestion of ESL paint is to meet a pre-determined level of paint degradation in the reactor. There is no supporting data available from either the bench or pilot scales that shows any sort of quantitative degradation; only a graphical representation of a disappearance of compounds from the water phase. For the exception of the VOCs measured, no conclusive data at the DEM/VAL level is available either. However, oxygen uptake measurements were taken, and, based on the results, biological degradation was occurring that most likely consisted of degradation of the VOCs. At this time it is very difficult, if not impossible, to determine the actual degradation of the resins and activators. For future research, developing test methods and/or testing schemes for evaluating the degradation of these constituents must be established before continuing with this process.

Table 6-3. Cost comparison of paint treatment versus paint disposal based on DEM/VAL biofilter efficiency numbers.

Value	Condition
4300	Gallon tank
1.395%	Maximum water:paint liquer treatable
60	Gallons of paint treated per run
4	Minimum number of days for theoretical residence time
52	Maximum number of runs per year
3120	Maximum gallons of paint that can be treated in one year
$61,245.60	Cost to treat 3120 gallons of paint
$19.63	Cost per gallon for treatment under current conditions

Table 6-4. Cost comparison of paint treatment versus paint disposal based on biofilter efficiency of 90 percent.

Value	Condition
4,300	Gallon tank
1.395%	Maximum water:paint liquer treatable
60	Gallons of paint treated per run
4	Minimum number of days for theoretical residence time
52	Maximum number of runs per year
3,120	Maximum gallons of paint that can be treated in one year
$55,036.80	Cost to treat 3120 gallons of paint
$17.64	Cost per gallon for treatment under ideal, more efficient conditions

6.3.1.2 Field test of SBR prototype at Pearl Harbor. SBR testing design for the system is shown in table 6-5. Initial values of nutrients were taken from earlier bench testing and literature reviews. A rational calculation basis from biological fundamental growth considerations was suggested and will be discussed later.

Table 6-5. SBR testing basis.

Parameter	Value
Paint Loading	500 – 1,000 gallons
Reactor Residence Time	5 – 10 days
Nitrogen as Ammonium	4 – 10 pounds per 5,000 gallons
Phosphorus as Phosphate	2 - 6 pounds per 5,000 gallons
Vitamins as Yeast Extract	1 – 5 pounds per 5,000 gallons
Amino Acids as Casein	1 – 10 pounds per 5,000 gallons

Table 6-5. SBR testing basis - Continued.

Parameter	Value
Biosolids Recycle	100 – 500 gallons of biomass concentrate
Air Flow	100 – 250 cubic feet per minute
Biofilter Residence Time	5 – 15 minutes

Biological System

The biological system is a Sequencing Batch Reactor (SBR). The SBR is an activated sludge biotreatment process that simulates an ideal plug-flow reactor. The operational steps are basically fill, react, separation of biomass from the treated waste solution, decanting of clarified water, and wasting of excess biomass and sludge. These steps are described in more detail, below:

- Concentrated biomass in the reactor is fed the target waste solution. The concentrated biomass is the settled biomass from the previous fill, treat, draw, and waste sequence.

- The feed waste solution is supplemented with nutrients, if required, and other chemical adjustments (e.g., pH adjustment, alkalinity) may be required to provide favorable environmental and substrate conditions for the biodegradation reaction.

- The mixture of biomass and waste solution is agitated and aerated and the mixture is allowed to react for the time required to achieve target biodegradation results.

- Mixing and aeration are stopped, and the mixture is allowed to separate by gravity sedimentation of the biomass.

- After clarification of the mixture is achieved, the treated wastewater supernatant is withdrawn from the reactor.

- Excess biomass (i.e., the anabolic amount produced in the metabolism of the substrate) is drawn from the settled biomass and further processed and disposed. (An alternative wasting process is to remove the required portion of mixed biomass and treated wastewater prior to the clarification step.)

- The reactor is now ready to repeat the treatment sequence.

Because the paint to be treated contains volatile organic compounds (VOCs), the exhaust gas is vented to the biofilters for treatment to prevent the release of the VOCs. The exhaust gases from the biofilters are discharged through activated carbon, which provides a final polishing step for removing residual VOCs not captured and destroyed within the biofilters.

Figure 6-7 is a picture of the SBR biological reactor at Pearl Harbor. The paint can crusher and paint feed system to the SBR are shown in figure 6-8.


Figure 6-7. SBR biological reactor.


Figure 6-8. Paint can crusher and paint feed system to the SBR.

Figure 6-9 shows the biofilters for treating the exhaust gases of the SBR, and figure 6-10 is a schematic of the elements of the biofilters system with activated carbon polishing is a schematic of the biofilters.

Figure 6-9. Biofilters for treating the exhaust gases of the SBR.

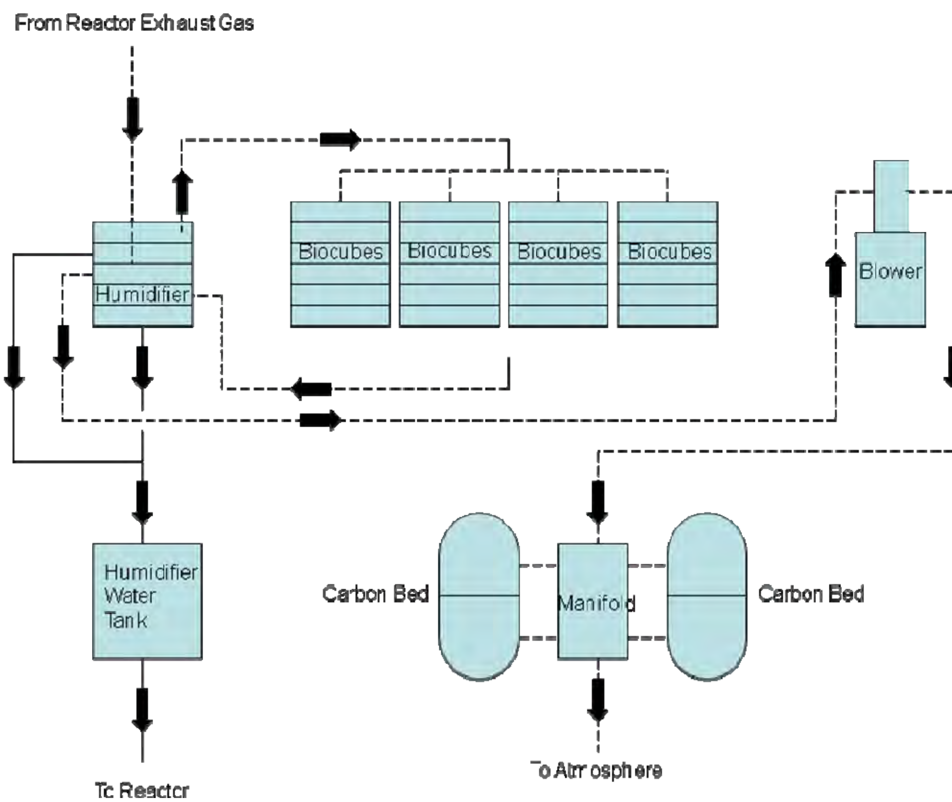


Figure 6-10. Biofilter treatment system schematic for ESL solvent-based paint exhaust gases.

The test runs were loaded as presented in table 6-6.

Table 6-6. Test run loads.

Component	Units	Run				
		Run 1	Run 2	Run 3	Run 4	Run 5
Paint	gal	25	40	60	74.0	36.0
Water	gal	4,375	4,375	4,375	4,375	4,375
Phosphorus	lbs	41.6	46.7	24.2	7.9	8.4
Yeast	lbs	7.5	7.5	7.5	9	9
N-amine	lbs	9	9	9	7.5	7.5
Nitrogen	lbs	8.6	9.7	10.1	38.9	41.5

The nutrient basis used the assumption of a yield range of biomass growth, and a common biomass empirical formulation (C5H7O2N) with an N:P ratio of 5:1, also typical in the estimation of phosphorus requirements. Figure 6-11 shows the calculation basis. It was postulated that this was a better way to estimate nutrients, assuming that a biomass yield would be developed from the SBR solids data.

Nutrient Requirements Based on Cell Yield			
Assumptions:			
Yield =		0.25 lb biomass/lb Paint	
Paint Loading	12 20-L cans	sg = 1.09	
lb Paint		576	
Empirical Formula for Biomass	$C_5H_7O_2N$		
MW		113	
N requirement	=14/113 =		0.12 lb N / lb biomass produced
P requirement	= N requirement / 5 =		0.02 lb P / lb biomass produced
Biomass Produced		144 lb biomass	
N Required		17.9 lb	
From N (Urea) 46% N		38.8 lb	
P Required		3.6 lb	
From P (TriSuperP) 45% N		7.9 lb	
Yeast		7.5 lb	(from previous runs)
NZ-Amine		9 lb	(from previous runs)
Highlighted is what is to be added			

Figure 6-11. Calculation of nutrient requirements based on biomass requirements for ESL paint biodegradation.

Due to the light biomass generated, during the first three test runs, it was decided to use coagulation and flocculation to assist in the biomass settling stage for Test Runs 4-6. Before coagulation and flocculation could be used, testing was required.

The coagulant testing was done using standard jar tests, as shown in figure 6-12. The results on the bench-scale were very good, as shown in figure 6-13, a comparison of coagulated-clarified water to untreated water.

Figure 6-12. Coagulation testing for Test Run 4.

Figure 6-13. Comparison of uncoagulated (left) and coagulated SBR treated ESL.

However, the results did not translate directly to the SBR, which is not configured for the coagulation/flocculation steps. The coagulation requires a thorough and rapid dispersion of the chemical coagulant, and the flocculation step is a fairly slow mix, floc-building by coagulated particle contact. Therefore, more biomass than desired from the reactor was transferred to the dedicated wastewater holding tank.

In order to rapidly increase biomass activity, the following steps were taken:

- Supplemented feed with easily degradable carbon source to build biomass. This was to see if the dormant biomass could be rapidly activated using a simple substrate such as sugar. After addition of sugar to the SBR, oxygen uptake rates were monitored, and a rapid increase of oxygen uptake was observed. This indicated that the biomass, in spite of several weeks of being unaerated and stagnant in the SBR, quickly was revitalized and was biologically active.

- Developed good bioactivity prior to paint feed

- Bench tested coagulation/flocculation for biomass separation. The bench testing is shown in figure 6-14. The concentrations of coagulants varied from the control (far left jar in the figure) with no coagulant to increasing coagulant dosages. The third through fifth jars, numbering from the left, showed the best clarity. The sixth jar, at the highest dosage, was overdosed, as evident from the poorer clarity. Figure 6-15 shows the separated solids on the bottom of the jar. Again, however, as observed in the February run, translation of this effect to the full-scale SBR operation was not as successful, despite attempts to provide rapid mixing and effective slower flocculation.

- Modified draw to retain larger fraction of biomass. This was done by selecting withdrawal points at the points [levels of highest clarity (lowest solids)].

Figure 6-14. Run 5 coagulation/flocculation testing.

Figure 6-15. Separated solids in Run 5 coagulation/flocculation testing.

Results of SBR Testing

The SBR testing showed that there was biological degradation of the ESL paint. The results are illustrated in the following sections.

Generic Parameters

The standard generic parameters monitored are shown, with results for all runs in table 6-7 for Runs 1 through 3 and in table 6-8 for Runs 4 through 5.

Table 6-7. SBR generic parameters for Runs 1 – 3.

Run	Run 1		Run 2			Run 3		
Date	**7/28/08**	**8/26/08**	**9/26/08**	**10/3/08**	**10/9/08**	**12/10/08**	**12/20/08**	**10/8/09**
Location	**SBR-B**	**SBR-B**	**SBR-B**	**SBR-B**	**SBR-B**	**SBR-B**	**SBR-B**	**SBR-B**
Ammonia as Nitrogen (mg/L)	136	143	58.4	38.6	45.5	64.9	123	152
BOD (mg/L)	38	39	397	258	176	4070	NT	42
COD (mg/L)	381	283	1660	960	878	860.5	4090	3580
Nitrogen (TKN) (mg/L)	119	110	83	70	76.8	245	197	203

Table 6-7. SBR generic parameters for Runs 1 – 3 - Continued.

Run	Run 1		Run 2			Run 3		
Date	**7/28/08**	**8/26/08**	**9/26/08**	**10/3/08**	**10/9/08**	**12/10/08**	**12/20/08**	**10/8/09**
Location	**SBR-B**	**SBR-B**	**SBR-B**	**SBR-B**	**SBR-B**	**SBR-B**	**SBR-B**	**SBR-B**
Orthophos-phate as Phosphorous (mg/L)	132	104	0.18	0.18	84.9	129	115	109
pH	7.68	8.07	7.23	7.12	7.86	6.705	7.17	7.22
TOC (mg/L)	93	73.1	49.5	168	144	297.5	3.9	148
Sulfate (mg/L)	NT	36		18	30.6	79	253	442
Nitrate + Nitrite as Nitrogen (mg/L)	NT	0.031	0.43	0.028	0.02	ND	0.06	0.031
Cl_2 (mg/L)	NT	NT	ND	ND	ND	ND	ND	ND
Cr^{6+} (mg/L)	NT	NT	ND	ND	ND	0.1	ND	ND
Settleable Solids (mg/L)	NT	NT	5.3	4.2	3.7		21	12
TSS (mg/L)	251	124	1140	680	616	3350	3620	3490
TVS (mg/L)	NT	NT	1520	965	960	5290	5120	1550

ND-Non-detect
NT-Not tested

Table 6-8. SBR generic parameters for Runs 4 – 5.

Run	Run 4			Run 5		
Date	**2/10/09**	**2/18/09**	**2/27/09**	**3/06/09**	**3/13/09**	**3/23/09**
Location	**SBR-B**	**SBR-B**	**SBR-B**	**SBR-B**	**SBR-B**	**SBR-B**
Ammonia as Nitrogen (mg/L)	507	598	499	857	915	802
BOD (mg/L)	1820	1030	1180	6190	1420	602
COD (mg/L)	7080	6370	3140	16700	12600	4700
Nitrogen (TKN) (mg/L)	423	650	615.5	1050	1310	895
Orthophosphate as Phosphorous (mg/L)	79.2	84.3	72.7	94.1	77.75	76.65
pH	7.96	8.375	8.31	8.63	8.67	8.99
TOC (mg/L)	995	832	724	1490	1640	619
Sulfate (mg/L)	181	201	170	422	730	597

Table 6-8. SBR generic parameters for Runs 4 – 5 - Continued.

Run	**Run 4**			**Run 5**		
Date	**2/10/09**	**2/18/09**	**2/27/09**	**3/06/09**	**3/13/09**	**3/23/09**
Location	**SBR-B**	**SBR-B**	**SBR-B**	**SBR-B**	**SBR-B**	**SBR-B**
Nitrate + Nitrite as Nitrogen (mg/L)	0.022	0.035	0.039	0.32	0.465	2.84
Cl_2 (mg/L)	ND	ND	ND	6.3	ND	ND
Cr^{6+} (mg/L)	ND	ND	ND	0.1425	ND	0.031
Settleable Solids (mg/L)	12	15	0.8	35	30	9.5
TSS (mg/L)	2260	2280	1120	7110	7000	2510
TVS (mg/L)	3040	2600	1605	8390	6100	3790

ND-Non-detect

Table 6-9 shows the results for Run 6.

Table 6-9. SBR generic parameters for Run 6.

Run	**Run 6**				
Date	**5/05/09**	**5/06/09**	**5/07/09**	**5/08/09**	**5/22/09**
Location	**SBR-A**	**SBR-A**	**SBR-A**	**SBR-A**	**SBR-A**
Ammonia as Nitrogen (mg/L)	573	467	541.666667	346	298
BOD (mg/L)	9000	9590	6200	3020	1500
COD (mg/L)	19300	27600	19500	17000	6035
Nitrogen (TKN) (mg/L)	848	635	685	618	466
Orthophosphate as Phosphorous (mg/L)	55.85	84	77	67.4	69.2
pH	8.72	8.13	7.84	7.79	8.18
TOC (mg/L)	1450	1590	1650	1160	1110
Sulfate (mg/L)	466	520	545	509	458
Nitrate + Nitrite as Nitrogen (mg/L)	3.67	3.5	0.025	1.17	0.05
Cl_2 (mg/L)	ND	ND	ND	ND	ND
Cr^{6+} (mg/L)	0.0125	0.007	0.0085	0.019	0.022
Settleable Solids (mg/L)	95.6	1000	24	17	2
TSS (mg/L)	9250	9500	10500	8450	1800
TVS (mg/L)	7750	8265	8800	6450	3295

ND-Non-detect

Plots of the various generic parameters are shown in figure 6-16 for biochemical oxygen demand (BOD5), chemical oxygen demand (COD), and total organic carbon (TOC). The values are shown versus sampling event. Table 6-10 shows the sample dates for these plots.

Table 6-10. Sampling event dates.

Run	Sample Date	Sampling Event Number
1	07/28/08	1
	08/26/08	2
2	09/26/08	3
	10/03/08	4
	10/09/08	5
3	12/10/08	6
	12/20/08	7
	01/08/09	8
4	02/10/09	9
	02/18/09	10
	02/27/09	11
5	03/06/09	12
	03/13/09	13
	03/23/09	14
6	05/05/09	15
	05/06/09	16
	05/07/09	17
	05/08/09	18
	05/22/09	19

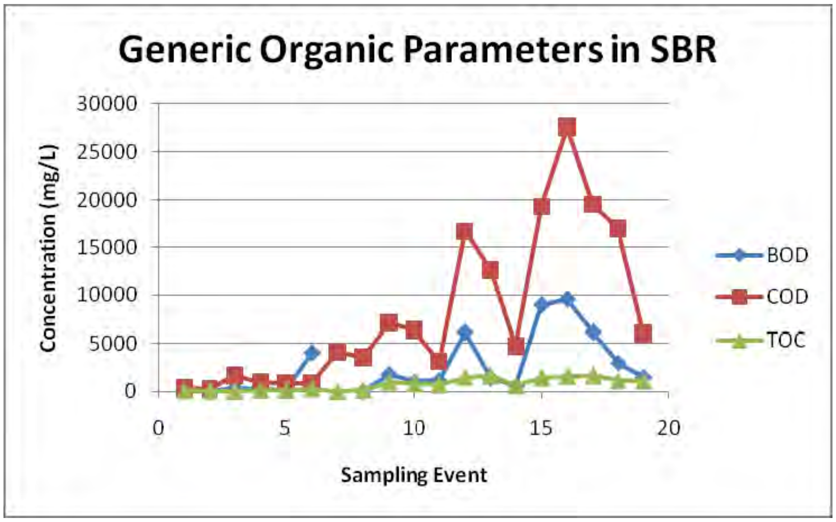


Figure 6-16. Generic organic parameters in SBR [biochemical oxygen demand (BOD_5), chemical oxygen demand (COD), and total organic carbon (TOC)].

Figure 6-17 is a plot of the total suspended solids (TSS) and total volatile solids (TVS). Figure 6-18 plots the nitrogen, ammonia and total Kjeldahl nitrogen (TKN), and figure 6-19 plots orthophosphate, showing the nutrient concentrations in the SBRs.

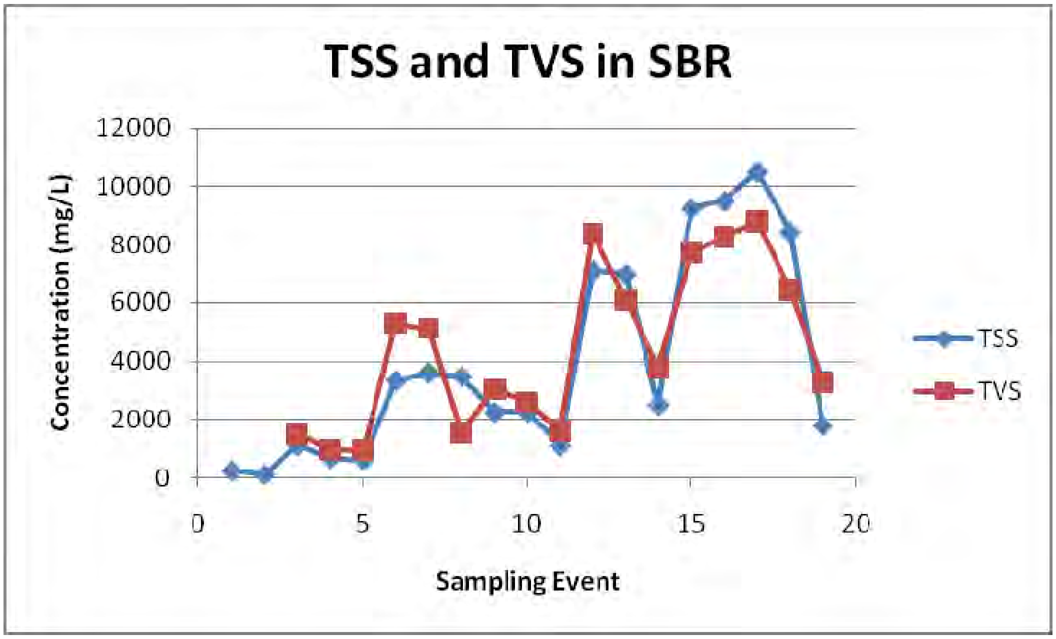


Figure 6-17. TSS and TVS in SBR.

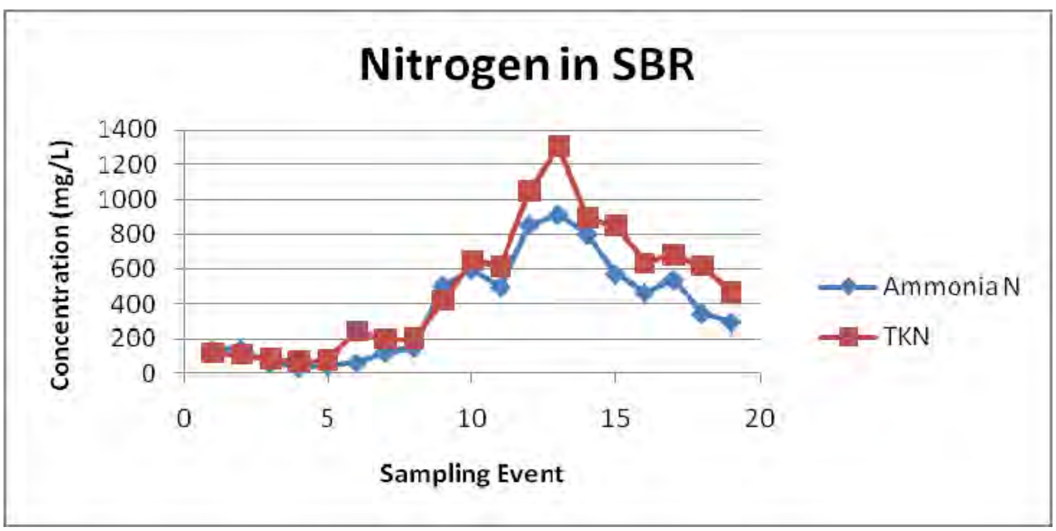


Figure 6-18. Nitrogen [ammonia and total Kjeldahl nitrogen (TKN)] in SBR.

The TSS concentrations in the SBRs will be a combination of biosolids and paint solids. The trends in the TSS versus time of each run are consistent with decrease in paint solids, indicating that paint solid biodegradation occurred during the runs.

The results of the generic organic parameters for each run show a decrease in the SBRs with time, demonstrating that there is biodegradation of the paint organics. It is noted, however, that significant organic concentrations remain in the SBR, and that they are biodegradable, as measured by BOD_5.

The nitrogen in the SBRs, as shown in figure 6-18, is in sufficient concentration that N will not be a limiting nutrient for biological reactions. In fact, it appears that excess nitrogen is available, and the nitrogen additions can be scaled back. However, with the data from the runs, it is not determinable as to the actual amount of scaling back that can be done, partially, because there is still residual biodegradable organic present at the end of the SBR run. That organic, serving as food for the biomass, will require N for the anabolic growth of the microorganisms.

It is also noted that the TKN relationship to ammonia-N is maintained throughout the measurements (TKN is the combination of organic-N and ammonia-N).

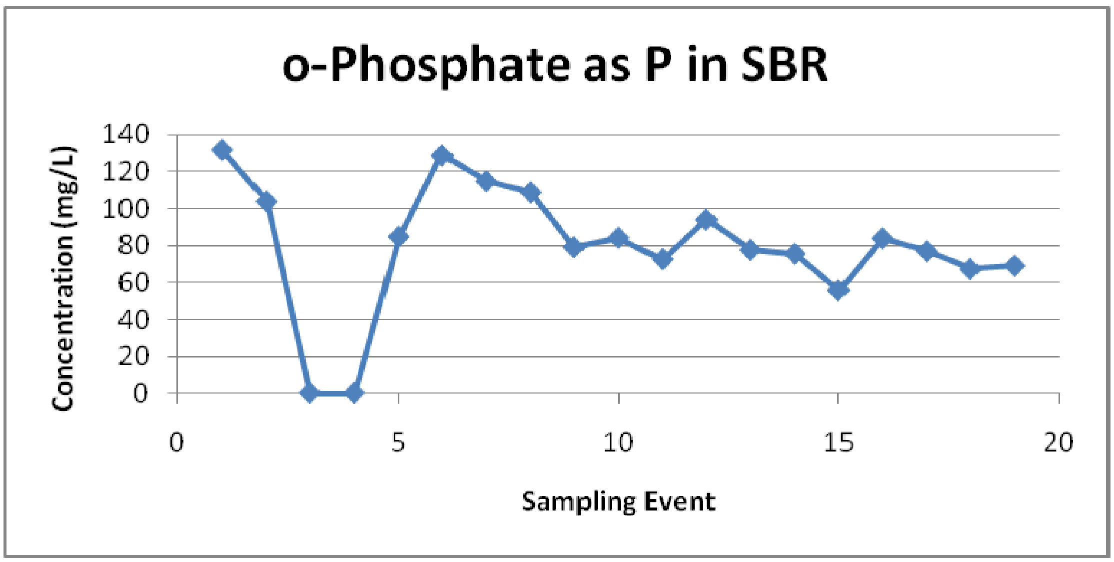


Figure 6-19. Orthophosphate in the SBRs.

The orthophosphate (o-P) in the SBRs, as shown in figure 6-19, is in sufficient concentration that P will not be a limiting nutrient for biological reactions. In fact, it appears that excess P is available, and the P additions can be scaled back. However, with the data from the runs, it is not determinable as to the actual amount of scaling-back that can be done, partially because there is still residual biodegradable organic present at the end of the SBR run. That organic, serving as food for the biomass, will require P for the anabolic growth of the microorganisms. Still, the P is very high, and definitely can be scaled back.

<u>Metals in SBR</u>

The metals in the SBR for Runs 1 through 2 are shown in table 6-11 and Run 3 is shown in table 6-12.

Table 6-11. Metals in SBR Runs 1 – 2.

Analyte	Run 1	Run 2		
	08/26/08	09/26/08	10/03/08	10/09/08
	Result (mg/L)	Result (mg/L)	Result (mg/L)	Result (mg/L)
Arsenic	0.0115	ND	0.0074	0.0079
Barium	0.0514	1.38	0.113	0.0999
Beryllium	0.000318	0.0015	0.000085	0.000158
Cadmium	0.0128	0.0575	0.00652	0.00638
Chromium	0.0606	0.345	0.0252	0.0313
Copper	0.63	2.75	0.229	0.384
Lead	0.0278	0.0575	0.00843	0.0155
Manganese	0.0342	0.156	0.0167	0.0164
Mercury	ND	ND	ND	ND
Nickel	0.0424	0.118	0.0339	0.0382
Selenium	ND	ND	ND	0.0019
Silver	0.000109	ND	0.000026	0.000063
Tin	NT	0.11	0.00011	0.00029
Titanium	NT	NT	0.107	0.0876
Zinc	0.445	3.31	0.327	0.394

ND-Non-detect
NT-Not tested

Table 6-12. Metals in SBR Run 3.

Analyte	Run 3		
	12/10/08	12/20/08	01/08/09
	Result (mg/L)	Result (mg/L)	Result (mg/L)
Arsenic	0.0121	0.0126	0.0109
Barium	2.14	1.08	2.7
Beryllium	0.00256	0.00211	0.00179
Cadmium	0.0838	0.0637	0.0544
Chromium	0.431	0.364	0.32
Copper	1.11	1.21	1.08
Lead	0.123	0.145	0.167

Table 6-12. Metals in SBR Run 3 - Continued.

Analyte	Run 3		
	12/10/08	12/20/08	01/08/09
	Result (mg/L)	Result (mg/L)	Result (mg/L)
Manganese	0.224	0.174	0.135
Mercury	0.00014	ND	ND
Nickel	0.157	0.144	0.12
Selenium	ND	ND	ND
Silver	0.00058	0.00026	0.000439
Tin	0.0508	0.00315	0.0494
Titanium	1.81	0.475	1.69
Zinc	4.75	3.16	3.16

ND-Non-detect
NT-Not tested

Table 6-13 shows the metals in the SBR for Runs 4 through 5 and table 6-14 shows Run 6.

Table 6-13. Metals in SBR Runs 4 – 5.

Analyte	Run 4			Run 5		
	2/10/09	2/18/09	2/27/09	3/06/09	3/13/09	3/23/09
	Result (mg/L)	Result (mg/L)	Result (mg/L)	Result (mg/L)	Result (mg/L)	Result (mg/L)
Arsenic	0.012	0.0115	0.01215	0.01875	0.0176	0.0108
Barium	0.825	0.832	0.2835	5.58	3.36	0.9755
Beryllium	0.00219	0.00205	0.001265	0.003205	0.002975	0.0005555
Cadmium	0.0666	0.0597	0.03825	0.09955	0.0883	0.016466667
Chromium	0.377	0.344	0.243	0.605	0.486	0.1255
Copper	1.35	1.43	1.485	2.485	2.49	3.725
Lead	0.18	0.165	0.1055	0.2655	0.2695	0.07895
Manganese	0.156	0.137	0.0905	0.4625	0.351	0.079
Mercury	ND	ND	ND	ND	ND	ND
Nickel	0.156	0.146	0.1315	0.226	0.2205	0.09905
Selenium	ND	ND	ND	ND	0.00295	ND
Silver	0.00401	0.00353	0.00227	0.01165	0.001885	0.000632
Tin	0.0576	0.0424	0.073	0.1395	0.1125	0.0479
Titanium	0.6	0.598	0.3465	2.3	1.32	0.4525
Zinc	3.23	3.01	2.1	5.675	4.57	1.965

ND-Non-detect

Table 6-14. Metals in SBR Run 6.

Analyte	Run 6				
	5/05/09	5/06/09	5/07/09	5/08/09	5/22/09
	Result (mg/L)	Result (mg/L)	Result (mg/L)	Result (mg/L)	Result (mg/L)
Arsenic	0.01635	0.018	0.01675	0.0168	0.0131
Barium	11.1	12.1	11.45	9.61	1.3
Beryllium	0.0003025	0.000679	0.000713	0.000934	0.000482
Cadmium	0.01075	0.0236	0.02355	0.0223	0.0147
Chromium	0.451	0.388	0.572	0.534	0.288
Copper	2.81	2.87	3	2.74	2.08
Lead	2.91	2.93	3.095	2.55	1.47
Manganese	14.35	13	17.5	14.4	1.59
Mercury	0.00008	0.00012	ND	0.00004	ND
Nickel	0.157	0.201	0.1965	0.193	0.149
Selenium	ND	ND	ND	ND	ND
Silver	0.006415	0.00471	0.003625	0.00288	0.000694
Tin	1.59	1.59	1.51	1.35	0.263
Titanium	1.355	1.18	1.675	1.28	0.286
Zinc	8.345	8.45	11.95	9.94	9.2

ND-Non-detect

A plot of the total heavy metals for the six runs is shown in figure 6-20. The sampling event for this set of data corresponds to the table 6-15.

The total heavy metals generally track the paint loadings, with the highest metal concentrations occurring in Run 6, which was the highest loading. The large concentration decrease in the final Run 6 sample may be due to metals associated with paint solids that also appeared to decrease in that sample. It can be concluded that the metals are tied up in the solids.

Table 6-15. Sampling event dates.

Run	Sample Date	Sampling Event Number
1	08/26/08	1
2	09/26/08	2
	10/03/08	3
	10/09/08	4
3	12/10/08	5
	12/20/08	6
	01/08/09	7
4	02/10/09	8

Table 6-15. Sampling event dates - Continued.

Run	Sample Date	Sampling Event Number
	02/18/09	9
	02/27/09	10
5	03/06/09	11
	03/13/09	12
	03/23/09	13
6	05/05/09	14
	05/06/09	15
	05/07/09	16
	05/08/09	17
	05/22/09	18

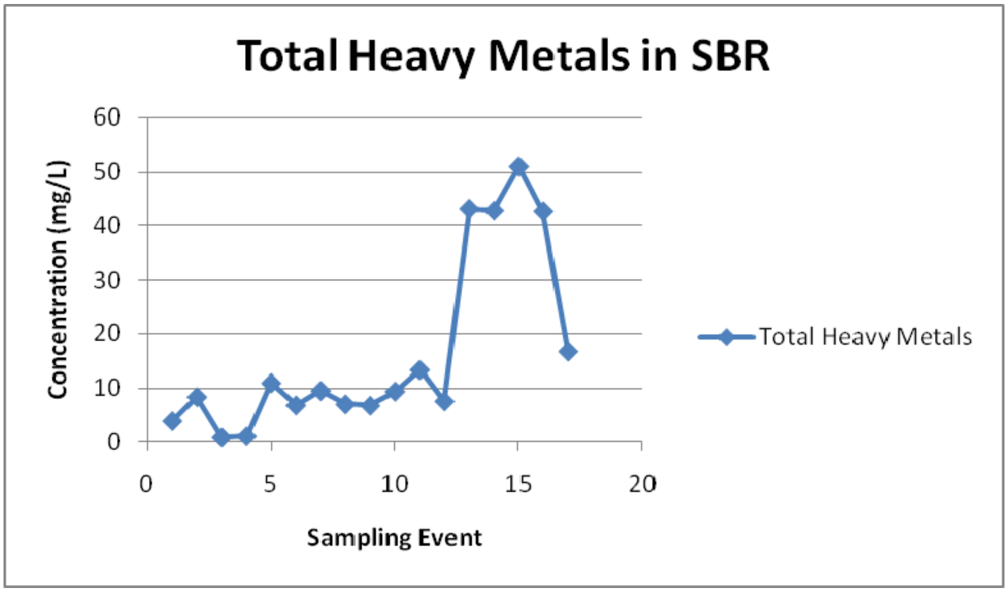


Figure 6-20. Total heavy metals in SBR Runs 1 – 6.

Total Toxic Organics (TTOs)

One issue that was raised is the concentration of total toxic organics (TTOs) in the final treated ESL paint wastewater from the SBR. The TTOs for volatile organic compounds (VOCs) and semi-volatile organic compounds (SVOCs) are plotted and shown in figures 6-21 and 6-22, respectively, and follow the same sampling event identification as for the heavy metals.

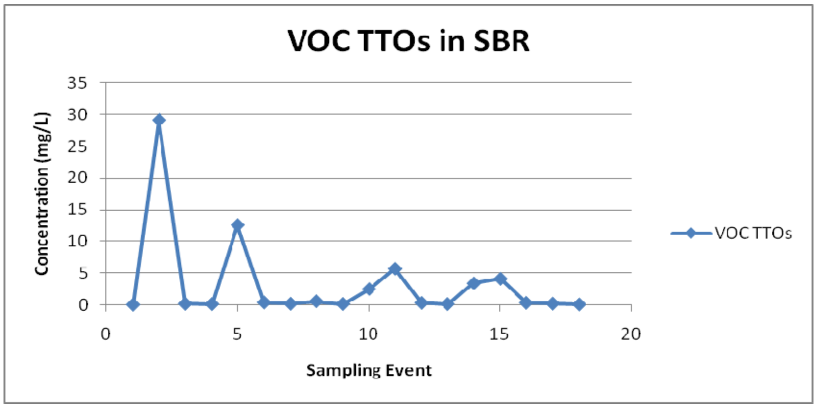


Figure 6-21. VOC total toxic organics in SBR.

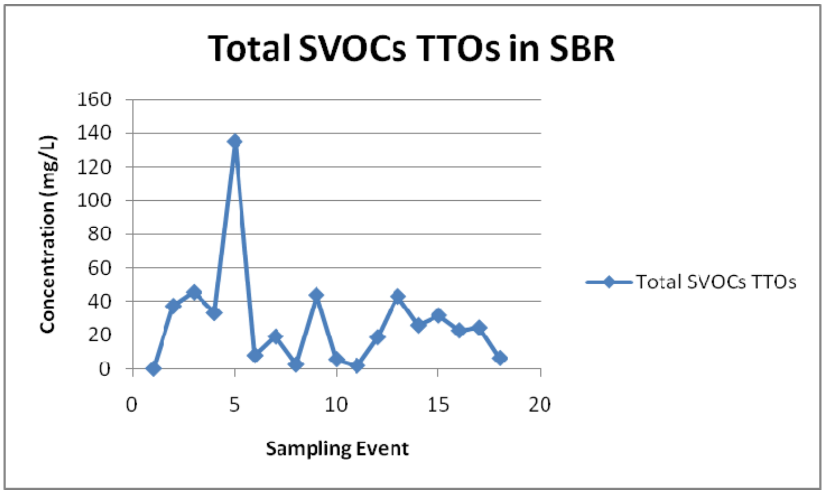


Figure 6-22. SVOC total toxic organics in SBR.

Metals in SBR Residual Solids

The residual solids that collected in the bottom of SBR B were sampled, with the results shown in table 6-16. The solids need to be tested by the TCLP (toxicity characteristic leaching procedure) to determine if the metals cause the residuals to be characterized as a characteristic hazardous waste.

Table 6-16. Metals in SBR residual solids.

Residual Solids in SBR-B				
Metal	**Sample 1**	**Sample 2**	**Sample 3**	**Average**
Arsenic	0.76	0.73	0.54	0.68
Barium	672	731	735	713
Beryllium	0.216	0.221	0.192	0.210
Cadmium	7.190	6.780	5.910	6.627
Chromium	52.6	42.6	33.1	42.8

Table 6-16. Metals in SBR residual solids - Continued.

Residual Solids in SBR-B				
Metal	**Sample 1**	**Sample 2**	**Sample 3**	**Average**
Copper	546	237	232	338
Lead	18.9	25.9	24.0	22.9
Manganese	27.10	38.00	32.7	32.6
Mercury	0.002	0.004	0.002	0.003
Nickel	20.7	15.8	15.0	17.2
Selenium	0.3	0.2	0.2	0.2
Silver	0.049	0.059	0.046	0.051
Tin	17	20	19	19
Titanium	384	510	501	465
Zinc	567	496	437	500

6.3.1.3 Post digestion-liquid phase. After 10 days of processing the paint, air and water samples were taken prior to transferring the contents to the dedicated holding tank. In order to discharge to the FK-WTP, the COMNAV base limits (which are more stringent than the EPA requirements) and TTO requirements had to be met. Tables 6-17 and 6-18 show all of these results. The COMNAV base limits and results are listed for each specific constituent. TTOs are also listed specifically, however, regulations require a total concentration of less than 2.13 mg/L.

Table 6-17. Results reported in milligrams per liter for constituent requirements.

Parameter	COMNAV Base limit (mg/L)	Run 2 Results (mg/L)	Run 3 Results (mg/L)	Run 4 Results (mg/L)	Run 5 Results (mg/L)
Ag	0.430	0.000	0.000	0.002	0.001
As	0.500	0.008	0.011	0.012	0.011
Ba	50.000	0.100	2.700	0.284	0.976
Be	0.200	0.000	0.002	0.001	0.001
Cd	0.690	0.006	0.054	0.038	0.016
Cr	2.770	0.031	0.320	0.243	0.126
Cr^{6+}	0.500	ND	ND	ND	0.031
Cu	3.380	0.384	1.080	1.485	3.725 [1.25]
Hg	0.050	0.000	0.000	ND	ND
Mn	N/A	0.016	0.135	0.091	0.079
Ni	3.980	0.038	0.120	0.132	0.099
Pb	0.690	0.016	0.167	0.106	0.079
Se	0.900	0.002	0.004	ND	ND
Sn	10.000	0.000	0.049	0.073	0.048

Table 6-17. Results reported in milligrams per liter for constituent requirements - Continued.

Parameter	COMNAV Base limit (mg/L)	Run 2 Results (mg/L)	Run 3 Results (mg/L)	Run 4 Results (mg/L)	Run 5 Results (mg/L)
Ti	0.500	0.088	1.690 [ND]	0.347	0.453
Zn	2.610	0.394	3.160 [0.145]	2.100	1.965
pH Range	5.5 – 9.5	7.860	7.220	8.310	8.990
Total Cyanide	1.200	NT	NT	NT	NT
Sulfide	5.000	NT	NT	NT	NT
TOC	1200.000	144	148.000	724.000	619.000
TPH	25.000	NT	[ND]	[33.7]	[ND]
Oil and Grease	150.000	[ND]	[ND]	[66]	[ND]
Nitrites*	5.000	0.02	0.031	0.039	2.84
Hydrazine	5.000	[ND]	[ND]	[ND]	[ND]
Peroxide	5.000	[ND]	[ND]	[2.0]	[ND]
Chlorine	50.000	[ND]	[ND]	[ND]	[ND]
TSS	600.000	616.000 [12]	3490.000 [34]	1120.000 [310]	2510.000 [88]
MBAS	30.000	[1.500]	[1.0]	[+]	[.8]

All results were taken from the last sample of each run.
* Measured as Nitrate+Nitrite as Nitrogen.
[ ] These constituents were tested for by the activity. The rest were completed by the contracted lab, Columbia Analytical Services.
NT-Not tested.
ND-Non-detect
N/A-Not applicable to this system.
+ -MBAS determination could not be made because an emulsion formed during chloroform extraction.
Yellow highlighted entries indicate results out of compliance with COMNAV requirements when first tested, but passed when retested after water settled (as shown in values inside brackets).
Orange highlighted entries indicate clarified water was polished through GAC, but final analytical results were never received.

Table 6-18. TTO results for the water phase at end of each run.

Organic Compound	Run 2 Results (mg/L)	Run 3 Results (mg/L)	Run 4 Results (mg/L)	Run 5 Results (mg/L)
Chloromethane	ND	0.00037	0.0007	0.0009
Vinyl Chloride	ND	ND	ND	ND
Bromomethane	0.002	ND	ND	ND
Chloroethane	ND	ND	ND	ND

Table 6-18. TTO results for the water phase at end of each run – Continued.

Organic Compound	Run 2 Results (mg/L)	Run 3 Results (mg/L)	Run 4 Results (mg/L)	Run 5 Results (mg/L)
1,1-Dichloroethene	ND	ND	ND	ND
Methylene Chloride	ND	ND	ND	0.0024
Trans-1,2-Dichloroethene	ND	ND	ND	ND
1,1-Dichloroethane	ND	ND	ND	ND
Chloroform	ND	0.00005	ND	ND
1,1,1-Trichloroethane (TCA)	ND	ND	ND	ND
Carbon Tetrachloride	ND	ND	ND	ND
1,2-Dichloroethane (EDC)	ND	ND	ND	ND
Benzene	ND	ND	0.0018	ND
Trichloroethene (TCE)	ND	ND	ND	ND
1,2-Dichloropropane	ND	ND	ND	ND
Bromodichloromethane	ND	ND	ND	ND
Toluene	0.0015	0.026	1.2	0.011
1,1,2-Trichloroethane	ND	ND	ND	ND
Tetrachloroethene (PCE)	ND	ND	ND	ND
Dibromochloromethane	ND	ND	ND	ND
Ethylbenzene	0.092	0.12	1.4	0.059
Bromoform	ND	ND	ND	ND
1,1,2,2-Tetrachloroethane	ND	ND	ND	ND
1,3-Dichlorobenzene	ND	ND	ND	ND
1,4-Dichlorobenzene	ND	ND	ND	ND
1,2-Dichlorobenzene	ND	ND	ND	ND
1,2,4-Trichlorobenzene	ND	ND	ND	ND
Naphthalene	0.0019	0.0007	0.044	0.0203
Hexachlorobutadiene	ND	ND	ND	ND
N-Nitrosodimethylamine	ND	ND	ND	ND
Bis(2-chloroethyl) Ether	ND	ND	ND	ND
Phenol	ND	ND	0.88	0.022
2-Chlorophenol	ND	ND	ND	ND
1,3-Dichlorobenzene	ND	ND	ND	ND
1,4-Dichlorobenzene	ND	ND	ND	ND
1,2-Dichlorobenzene	ND	ND	ND	ND
Bis(2-chloroethyl) Ether	ND	ND	ND	ND
Hexachloroethane	ND	ND	ND	ND
N-Nitrosodi-n-propylamine	ND	ND	ND	ND
Nitrobenzene	ND	ND	ND	ND

Table 6-18. TTO results for the water phase at end of each run – Continued.

Organic Compound	Run 2 Results (mg/L)	Run 3 Results (mg/L)	Run 4 Results (mg/L)	Run 5 Results (mg/L)
Isophorone	ND	ND	ND	ND
2-Nitrophenol	ND	ND	ND	ND
2,4-Dimethylphenol	ND	ND	ND	ND
Bis(2-chloroethoxy)methane	ND	ND	ND	ND
2,4-Dichlorophenol	ND	ND	ND	ND
1,2,4-Trichlorobenzene	ND	ND	ND	ND
Naphthalene	ND	ND	0.13	0.33
Hexachlorobutadiene	ND	ND	ND	ND
4-Chloro-3-methylphenol	ND	ND	ND	ND
Hexachlorocyclopentadiene	ND	ND	ND	ND
2,4,6-Trichlorophenol	ND	ND	ND	ND
2-Chloronaphthalene	ND	ND	ND	ND
Acenaphthylene	ND	ND	ND	ND
Dimethyl Phthalate	ND	ND	ND	ND
2.6-Dinitrotoluene	ND	ND	ND	ND
Acenaphthene	ND	ND	ND	ND
2,4-Dinitrophenol	ND	ND	ND	ND
4-Nitrophenol	ND	ND	ND	ND
2,4-Dinitrotoluene	ND	ND	ND	ND
Fluorene	ND	ND	ND	ND
4-Chlorophenyl Phenyl Ether	ND	ND	ND	ND
Diethyl Phthalate	ND	ND	ND	ND
2-Methyl-4,6-dinitrophenol	ND	ND	ND	ND
N-Nitrosodiphenylamine	ND	ND	ND	ND
4-Bromophenyl Phenyl Ether	ND	ND	ND	ND
Hexachlorobenzene	ND	ND	ND	ND
Pentachlorophenol	ND	ND	ND	ND
Phenanthrene	ND	ND	ND	ND
Anthracene	ND	ND	ND	ND
Di-n-butyl Phthalate	0.22	0.099	ND	0.21
Fluoranthene	ND	ND	ND	ND
Pyrene	ND	ND	ND	ND
Butyl Benzyl Phthalate	33	19	4.7	42
3,3'-Dichlorobenzidine	ND	ND	ND	ND
Benz(a)anthracene	ND	ND	ND	ND
Chrysene	ND	ND	ND	ND
Bis(2-ethylhexyl) Phthalate	0.023	0.12	ND	0.4

Table 6-18. TTO results for the water phase at end of each run – Continued.

Organic Compound	Run 2 Results (mg/L)	Run 3 Results (mg/L)	Run 4 Results (mg/L)	Run 5 Results (mg/L)
Di-n-octyl Phthalate	ND	ND	ND	ND
Benzo(b)fluoranthene	ND	ND	ND	ND
Benzo(k)fluoranthene	ND	ND	ND	ND
Benzo(a)pyrene	ND	ND	ND	ND
Indeno(1,2,3-cd)pyrene	ND	ND	ND	ND
Dibenz(a,h)anthracene	ND	ND	ND	ND
Benzo(g,h,i)perylene	ND	ND	ND	ND
TTO	**33.3404**	**19.36612**	**8.3565**	**43.1553**

ND-Non-detect

Even though the water was not clarified, most of the results listed in table 6-15 would pass COMNAV requirements with the exception of titanium and zinc for Run 3, copper for Run 5, total petroleum hydrocarbons (TPH) for Run 5, and total suspended solids for all of the runs. After clarification, analyses of those constituents that didn't pass were reanalyzed. It was then discovered that the levels had dropped and were now within discharge requirement limits. Tables 6-19, 6-20, and 6-21 show the complete results for titanium, zinc and copper, respectively, from all of the samples for the particular run they were out of compliance.

Table 6-19. Titanium results for all three samples of Run 3.

Date	COMNAV Base Limit (mg/L)	Run 3 Results (mg/L)
12/10/08	0.5	1.81
12/20/08	0.5	0.475
01/08/09	0.5	1.69

Table 6-20. Zinc results for all three samples of Run 3.

Date	COMNAV Base Limit (mg/L)	Run 3 Results (mg/L)
12/10/08	2.61	4.75
12/20/08	2.61	3.16
01/08/09	2.61	3.16

Table 6-21. Copper results for all three samples of Run 5.

Date	COMNAV Base Limit (mg/L)	Run 5 Results (mg/L)
03/06/09	3.38	2.485
03/13/09	3.38	2.49
03/23/09	3.38	3.725

After the water was transferred to the dedicated holding tank and allowed to settle, another set of samples were taken by the activity to ensure that the water passed COMNAV Base limits. All of the COMNAV Base limits were met for all test runs with the exception of TTO. Based upon this information, the metals were tied to the suspended solids and not necessarily dissolved in the water phase. Although two types of solids were generated, biomass and un-degraded paint, it is not clear if the metals in the suspended solids were part of the biomass or small particles consisting of un-degraded paint.

As shown in table 6-18, the 2.13 mg/L TTO limit was never met. However, if the compound butyl benzyl phthalate (an SVOC) were removed from the totals, the results for TTO for all runs, except one, are within compliance, as presented in table 6-22.

Table 6-22. TTO for all four runs minus the semi-volatile compound, butyl benzyl phthalate.

Organic Compound	**Run 2 Results (mg/L)**	**Run 3 Results (mg/L)**	**Run 4 Results (mg/L)**	**Run 5 Results (mg/L)**
TTO	33.3404	19.36612	8.3565	43.1553
Butyl Benzyl Phthalate (BBP)	33	19	4.7	42
TTO minus BBP	0.3404	0.36612	3.6565	1.1553

Butyl benzyl phthalate is typically a degradable organic compound. At this time it is not clear why degradation of this compound was limited and, therefore, more research is required to assess the degradation issue. The research would entail determining the origin of the compound (i.e., is it in the paint, is it a byproduct, or is it influenced by some abiotic mechanism). One would suspect that it is either in the paint or is an intermediate of xylene degradation, or both. In any case, the compound should be degraded and not accumulated. However, if accumulation is determined to be occurring, possible factors could include pH and/or insufficient nitrogen and phosphorous. Based upon the laboratory data, sufficient nitrogen and phosphorous was available. Therefore, additional testing should be conducted looking, specifically, at BBP concentrations in paint tested as well as BBP levels throughout the degradation cycle. Based upon the findings, a solution should be identified easily because BBP is readily biodegraded.

FTIR analysis was utilized for the liquid phase to determine levels of biodegradation and characterize the constituents. Three samples over time (early in the process, mid-process, and at the end) were taken for each run to represent progressive digestion of the paint.

Figures 6-23, 6-24, 6-25 and 6-26 present the FTIR spectra of the three samples for each run. Figure 6-23 and 6-24 graph the results of an acrylic resin, figure 6-25 is of a solvent-based enamel, and figure 6-26 graphs the spectra for an epoxy-polyamide resin. The reduction in certain peaks depicts successful degradation of properly emulsified paints or solidification of paint components.

The spectra from Run 2 with an acrylic resin, as shown in figure 6-23, suggests that significant degradation of organic matter or setting and settling of the paint has occurred. Hydrocarbon peaks in the 3000 to 2800 cm-1 range significantly decreased over time and the carbonyl peak at 1728 cm-1 has nearly disappeared. For Run 3, depicted in figure 6-24, the same type of acrylic

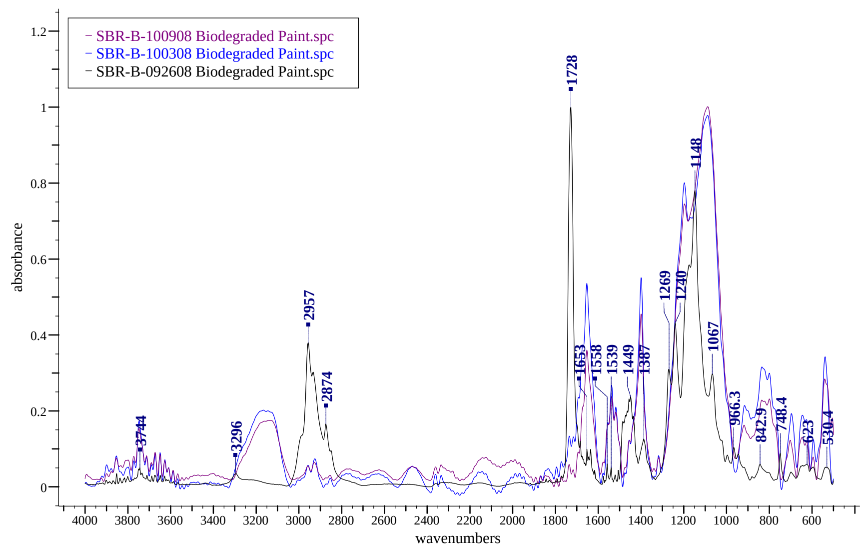


Figure 6-23. FTIR spectra of biodegraded acrylic resin 1.

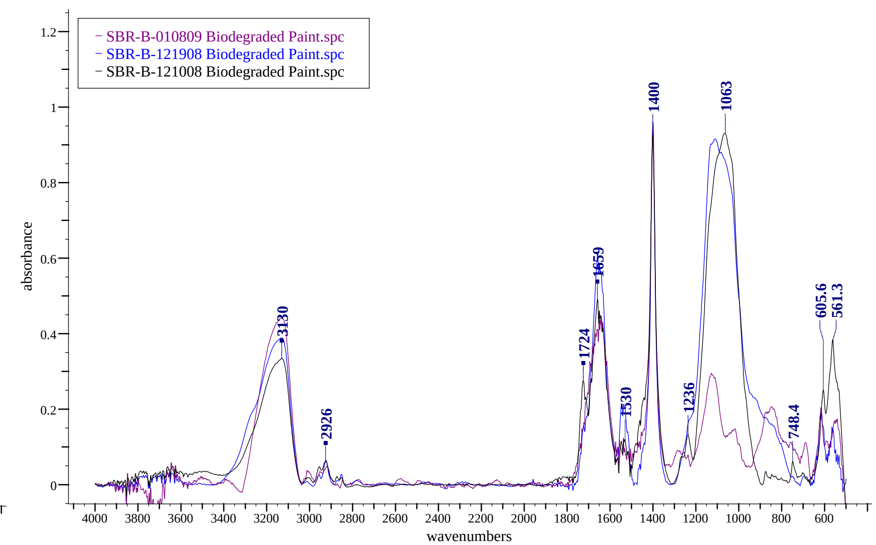


Figure 6-24. FTIR spectra of biodegraded acrylic resin 2.

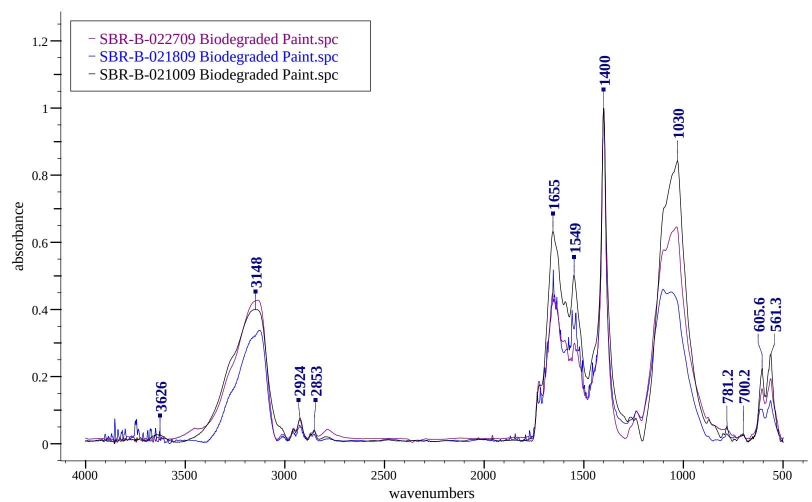


Figure 6-25. FTIR spectra of biodegraded solvent-based enamel.

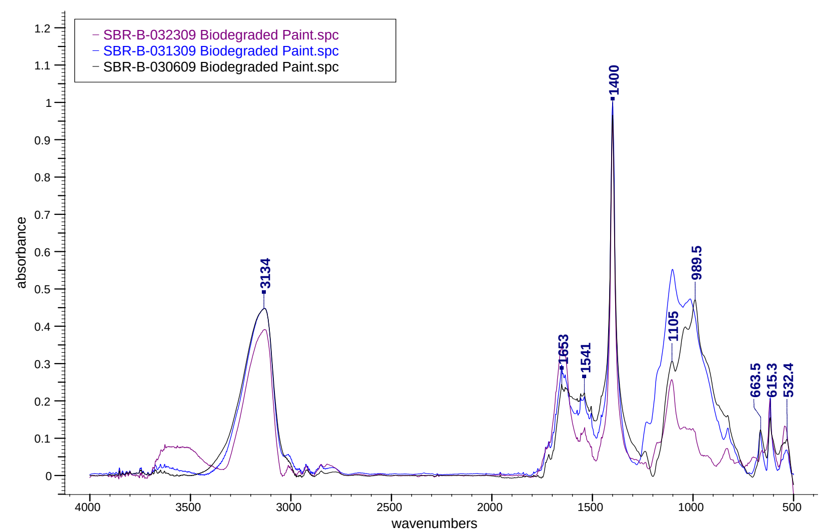


Figure 6-26. FTIR spectra of biodegraded epoxy polyamide resin.

resin was biodegraded with the same organic removal or setting and settling results as in the previous run. Figure 6-25 graphs the spectra from Run 4, in which solvent-based enamel was tested for biodegradation. The results are more inconclusive because even with the first sample of the run, the hydrocarbon peaks are nearly nonexistent. Two conclusions could be drawn: 1) emulsification was inadequate and the majority of the paint simply settled, or 2) the microbes digested the organic extremely quickly. The biodegradation of an epoxy polyamide resin from Run 5 is depicted in figure 6-26. Similarly, as in the Run 3 results, the resin and hydrocarbon peaks are nearly nonexistent, indicating quick degradation or poor emulsification and subsequent settling of the paint. Unfortunately, based on the amount of sludge that was generated during the DEM/VAL, it can be concluded that the majority of the paint, with the exception of the VOCs, set and settled to the bottom of the reactors.

Review of the pilot study water phase results reveals major deficiencies and issues with the study. While most of the COMNAV requirements were met during the DEM/VAL, the water phase still could not be discharged directly to the FK-WTP without further treatment and cost because of the TTOs. The total failure to meet TTO regulations and, more specifically, the extremely high concentration of butyl benzyl phthalate, an otherwise degradable compound, must be studied further. As stated before, removal of solids would also be required before discharge so that the metal requirements can be met. This can be accomplished by simple filtration to expedite the clarification of the water phase. (Costs using GAC beds for organic removal in the water phase are incorporated in the cost analysis.)

Certain species will create lighter and less dense flocs that don’t settle well. More research and analysis would also be required to determine the movement of metals within the different phases. Finally, significant more research would be required to demonstrate that any degradation at all is actually occurring as opposed to a dilution and settling process. Proper shearing and emulsification of the paint is so critical to successful degradation. Without it, the paint is unavailable to the microbes for digestion. No study to date has proven substantial quantitative aerobic digestion of paint, with the exception of the VOCs contained in paint.

6.3.1.4 Post digestion-solid phase. When biologically degrading paint, sludge is always left behind for various reasons. First, paint is comprised of many inorganic compounds and constituents that do not biologically degrade, such as metals. Secondly, it is unrealistic to believe 100 percent degradation of all organic material will occur. Therefore, one would expect a certain amount of organic material left behind as sludge. The classification of this sludge is very important to the overall economic feasibility of this process. Hazardous waste disposal is almost 3 times as expensive as nonhazardous waste. However, in order for the sludge to be classified as nonhazardous, it must pass TCLP for organics and metals.

Three composite samples at different locations of the reactor were taken from the sludge that settled to the bottom of the reactor after all 5 test runs were completed, as shown in figure 6-27. The sampling of the sludge only occurred at the end of the project because there was no easy way to collect the sludge from the reactor and there was no real need to dispose of sludge prior to completion. The sludge accumulated at the bottom of the reactor throughout the project. TCLP testing was conducted and the results are presented in tables 6-23 and 6-24. In all cases, TCLP results were in compliance with all TCLP requirements.

Figure 6-27. Interior bottom of SBR B.

Table 6-23. TCLP-metal requirements for disposal of non-hazardous sludge.

Metal	Regulatory Levels (mg/L)	Sample 1 (mg/L)	Sample 2 (mg/L)	Sample 3 (mg/L)
Arsenic	5.0	0.0100	0.0100	0.0100
Barium	100.0	0.3000	0.3900	0.3000
Cadmium	1.0	0.0040	0.0040	0.0020
Chromium	5.0	0.0040	0.0030	0.0030
Lead	5.0	0.0200	0.0200	0.0200
Mercury	0.2	0.0004	0.0004	0.0004
Selenium	1.0	0.0200	0.0200	0.0200
Silver	5.0	0.0070	0.0070	0.0070

Table 6-24. TCLP-organic requirements for disposal of non-hazardous sludge.

VOC	Regulatory Levels (mg/L)	Sample 1 (mg/L)	Sample 2 (mg/L)	Sample 3 (mg/L)
Vinyl Chloride	0.2	ND	ND	ND
1,1-Dichloroethene	0.7	ND	ND	ND
MEK	200	ND	ND	ND
Chloroform	6	ND	ND	ND
Carbon Tetrachloride	0.5	ND	ND	ND

Table 6-24. TCLP-organic requirements for disposal of non-hazardous sludge – Continued.

VOC	Regulatory Levels (mg/L)	Sample 1 (mg/L)	Sample 2 (mg/L)	Sample 3 (mg/L)
1,2-Dichloroethane	0.5	ND	ND	ND
Benzene	0.5	ND	ND	ND
Trichloroethene (TCE)	0.5	ND	ND	ND
Tetrachloroethene (PCE)	0.7	ND	ND	ND
Chlorobenzene	100	ND	ND	ND
1,4-Dichlorobenzene	7.5	ND	ND	ND
SVOC	**Regulatory Levels (mg/L)**	**Sample 1**	**Sample 2**	**Sample 3**
Pryidine	5	ND	ND	ND
2-Methylphenol	200	ND	0.027	0.013
Hexachloroethane	3	ND	ND	ND
4-Methylphenol	200	0.024	0.022	ND
Nitrobenzene	2	ND	ND	ND
Hexachlorobutadiene	0.5	ND	ND	ND
2,4,6-Trichlorophenol	2	ND	ND	ND
2,4,5-Trichlorophenol	400	ND	ND	ND
2,4-Dinitrotoluene	0.13	ND	ND	ND
Hexachlorobenzene	0.13	ND	ND	ND
Pentachlorophenol	100	ND	ND	ND

ND = Non-detect

Total metals, total organic carbon, and total solids results are listed in tables 6-25 and 6-26. Although the sludge passed TCLP for metals, the total metals results show a significant amount of metals in the sludge. It is theorized that the metals are tied up in the sludge in a matrix that stabilizes them and keeps them from leaching. Furthermore, with proper paint analyses these types of results could be utilized in a mass balance of metals and organics to determine metal phasing and organic degradation. As indicated in table 6-26, there is significant carbon remaining, indicating incomplete degradation.

Table 6-25. Total metals results from three sludge samples.

Analyte	Sample 1 Results (mg/kg)	Sample 2 Results (mg/kg)	Sample 3 Results (mg/kg)
Arsenic	0.76	0.73	0.59
Barium	672	731	748
Beryllium	0.216	0.221	0.1885

Table 6-25. Total metals results from three sludge samples – Continued.

Analyte	Sample 1 Results (mg/kg)	Sample 2 Results (mg/kg)	Sample 3 Results (mg/kg)
Cadmium	7.19	6.78	5.7
Chromium	52.6	42.6	33.7
Copper	546	237	238
Lead	18.9	25.9	24.3
Manganese	27.1	38	32.6
Mercury	0.002	0.004	ND
Nickel	20.7	15.8	14.65
Selenium	0.3	0.2	ND
Silver	0.049	0.059	0.045
Tin	17	20	19
Titanium	384	510	507.5
Zinc	567	496	428
Totals	2313.8	2124.3	2052.3

ND = Non-detect

Table 6-26. Results for total solids and total organic carbon from three sludge samples.

Analyte	Sample 1 Results (%)	Sample 2 Results (%)	Sample 3 Results (%)
Total solids	44.85	35.1	36.2
Total organic carbon	39.30	40.5	41.7

FTIR analysis was also utilized to characterize the sludge prior to disposal. Spectra for the 3 different samples taken from the bottom of the process tank are shown in figure 6-28. The strong hydrocarbon peaks between the 3000 to 2800 cm-1 region indicate significant remaining organic matter. And, specifically, sample number 501686's peaks were compared against the commercial FTIR library, where a possible match with a mixture of resin components found in coatings was identified. The results indicate that although the spectra show partial biodegradation, the infrared behavior of the remaining sludge exhibits undigested organic resins or activator components.

In summary, comparing the FTIR analysis of the sludge samples to the liquid samples (where far more biodegradation was shown), the results suggest that much of the paint, if not all, is not being degraded and is actually settling to the bottom with the exception of the VOCs. Explanations for this could be, again, the inadequate emulsification and shearing of the paint early in the process, making the paint unavailable to the microbes; a weak microbiological population; and/or an inadequate process time, which is not likely.

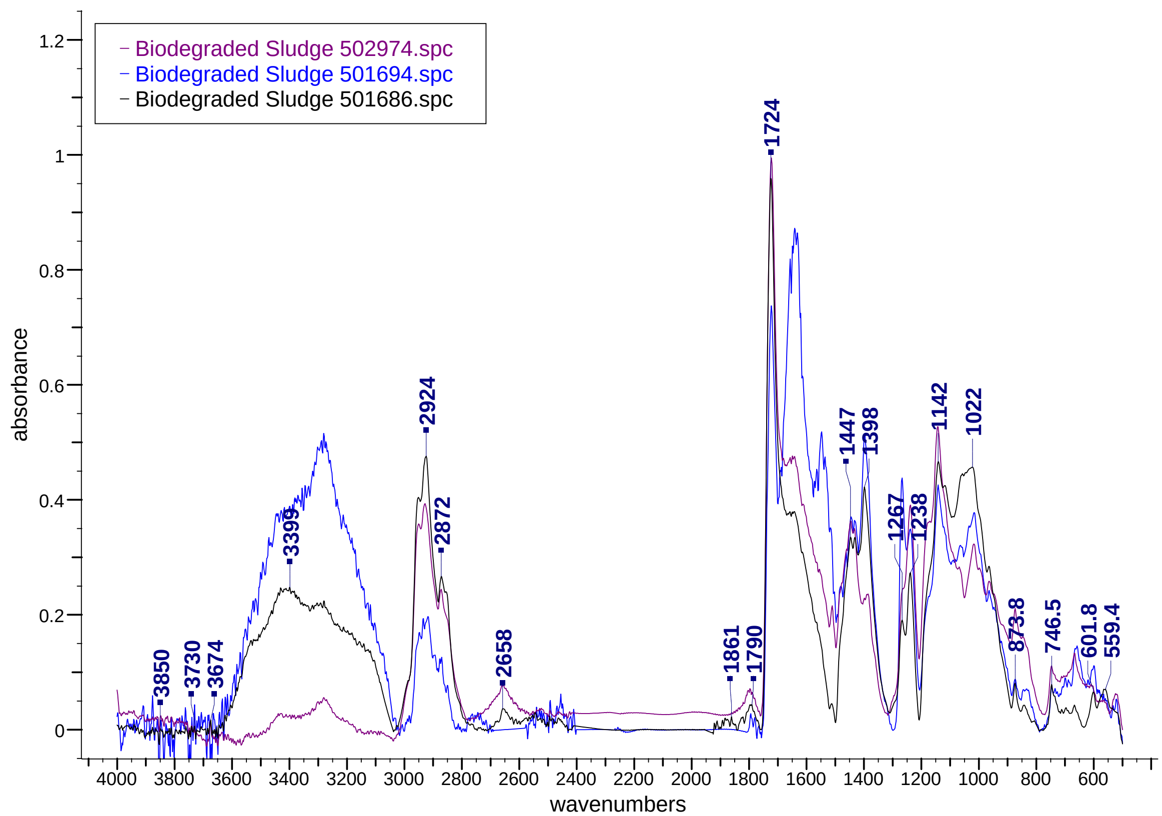


Figure 6-28. FTIR spectra of biodegraded resin by-product in sludge taken from bottom of process tank.

6.3.1.5 Post digestion-air phase. When degrading an exhaust gas with high VOC content, the degradation process is required to meet clean air regulations. For this system, an air-biofiltration system with an activated carbon filter at the end for polishing was installed. The success criteria for the air biofiltration system is based on Title V requirements (i.e., a reduction of 95 percent of VOCs entering and exiting the system). It should be noted that for the demonstration the process was not required to meet these regulations. However, activated carbon for polishing was a requirement. Table 6-27 lists the concentrations at the inlet and outlet of the biofilters and at final exhaust (after the carbon filter). Table 6-28 shows a summation of reductions for each run.

The activated carbon filter was critical for removal of the VOCs before final emission. There were only 2 times that it did not meet the 95 percent reduction standard: February 27, 2009 and March 23, 2009, and both of these times, the concentration of VOCs coming into the system was already extremely low, making a 95 percent removal difficult. Furthermore, if the concentrations are added as a total for each run, as listed in table 6-26, the activated carbon filter always met the required reductions for each run.

The biofilters were unable to ever meet the standard and, sometimes, percent reductions were below 50 percent, resulting in the majority of the VOC being removed by the activated carbon. However, the system did significantly improve over time. With more acclimation and more consistent run time, the unit would establish a more robust microbiological population, leading to

Table 6-27. Concentrations and reductions across the air biofiltration process.

Run	Date	VOC Concentration of Digestor Exhaust (mg/m3)	VOC Concentration of Biofilter Exhaust (mg/m3)	VOC Concentration of Activated Carbon Filter Exhaust (mg/m3)	Reduction Across Biofilters	Reduction Across Biofilters & Activated Carbon Filter
2	09/26/08	962.50	754.22	0.49	21.64%	99.95%
	10/03/08	5.20	6.91	0.13	-32.88%	97.50%
	10/09/08	186.19	0.03	0.17	99.98%	99.91%
3	12/10/08	333.07	232.87	0.14	30.08%	99.96%
	12/20/08	152.60	10.64	1.52	93.03%	99.00%
	01/08/09	240.91	68.29	8.48	71.65%	96.48%
4	02/10/09	101.04	37.45	0.32	62.94%	99.68%
	02/18/09	13.57	3.11	0.21	77.08%	98.45%
	02/27/09	35.66	3.70	2.56	89.62%	92.82%
5	03/06/09	323.40	186.12	0.24	42.45%	99.93%
	03/13/09	132.88	9.98	0.29	92.49%	99.78%
	03/23/09	3.51	0.56	0.27	84.05%	92.31%

Table 6-28. Total air VOC concentrations and reductions for each run.

Run	Total VOC Concentration of Digestor Exhaust for All Samples	Total VOC Concentration of Biofilter Exhaust for All Samples	Total VOC Concentration of Activated Carbon Exhaust for All Samples	Total VOC Reduction Across Biofilters	Total VOC Reduction Across Biofilters & Activated Carbon
2	1,153.89	761.16	0.79	34.04%	99.93%
3	726.58	311.80	10.14	57.09%	98.60%
4	150.27	44.26	3.09	70.55%	97.94%
5	459.79	196.66	0.80	57.23%	99.83%

higher removal rates.Further consistent testing, in which the biofilters are run regularly, would likely improve operation and efficiency of the biofiltration system. With the DEM/VAL project, runs were far apart, which likely led to some population die-off. There is no way to remedy this without using simple consistent system run-times. If this were the case, and the biofilters were able to achieve a consistent 90 percent or greater removal of VOCs, the burden on the GAC would be less. However, the biofilters would always require an activated carbon filter to ensure Title V compliance. The air waste stream from this process is so heavily laden with VOCs, that the use of activated carbon for polishing is the third highest cost, per gallon, when running the system. With a target cost of $9.19 or less per gallon of paint, the biofilters would be required to reach a more optimal level.

6.3.1.6 Cost reductions. To meet cost reduction performance objectives, two main objectives were imposed on the project, based on the pilot study report. The system should show a less than 2-year payback and annual costs, as compared to contract disposal of paint, should be equal to or less than $9.19. As discussed further in section 7.0, neither of these two objectives is met. Based on 90 percent biofiltration system efficiency, operation of the current system costs $17.64 per gallon of paint compared to system setup costs of $658,450.00. Current disposal through DRMO costs $9.19, thereby making payback impossible. Factors contributing to the elevated costs, in order of significance, are throughput [affects fixed costs (i.e., labor, electricity)], KWATT-H cost, activated carbon, N-Z amine, and degradation efficiency of the paint. In order to have a chance of making this process cost-effective, the current system throughput would have to be increased from 60 gallons to 200 gallons per treatment cycle. After this has been accomplished, other strategies can be used to further reduce costs (i.e., significantly improve degradation efficiency and eliminate the need for N-Z amine).

6.3.2 Qualitative Performance Objectives

The qualitative performance objectives of the DEM/VAL study focus on making the equipment more readily available for parts and assembly and the process more efficient to run. After the initial installation and subsequent delays due to inadequate design, assembly and operation of the system were successful. Though the process itself requires further investigation and study before validation is possible, the parts and equipment chosen for the system proved to be adequate and low-maintenance. Objectives from table 3-1 are described and explained in detail in the following paragraphs.

The objective for the procurement of system parts was to use readily available, off-the-shelf components. This objective was met, even for parts procured during the initial redesign and installation.

The system assembly objective was specifically to procure and install the reactors, pumps, valves, can-crusher, and biofilters within 3 months of the contract award. Procurement and installation began within the 3-month timeline. However, system inadequacies and poor design delayed the completion of this objective for another 9 months. Additional travel and contract modifications were required to address 2 major issues: biofilter design and exhaust piping incompatibility.

When the initial cost of the system was put together for the ESTCP proposal, the can crusher and its exhaust requirements were not well understood. Not until the can crusher was purchased and the exhaust system studied were the flow requirements better understood. Conversations with the can-crushing manufacturer determined that the minimal flow rate for exhausting the can crushers and capturing the volatile and semi-volatile organic compounds was 250 cubic feet per minute, making the current biofilter design inadequate. More biofilters were required to compensate for the additional flow rate during the can-crushing phase. This process required a redesign and an additional contract with a biofilter manufacturer to ensure functionality.

The initial design of the treatment process also specified CPVC for the exhaust piping. However, further investigation, regarding the compatibility of CPVC with the type of organic compounds found in solvent-based paint, revealed that not only was this a poor choice, but CPVC is never recommended for any type of material carrying these organic compounds. However, the contractor installed schedule 40 PVC that was eventually changed to schedule 80 PVC.

For the startup and optimization objective, startup did occur within 1 month of installation. Four thousand two hundred and seventy-five gallons of water, 25 gallons of paint, and the appropriate amount of nutrients were added to the process as an initial run, as well as for growing and acclimating microbiological population. However, an optimal environment was never reached, so optimization was never achieved. As the data was analyzed throughout the project, the inability to adequately shear and emulsify the paint for degradation became apparent. This is an incredibly critical point in the system. Redesign of the reactor pumps would likely be required to address the issue.

The remaining objectives (ease of operation, operator safety, operational requirements, maintenance requirements, and reliability) were all met by reducing manpower, automating, and carrying out correct operational procedures while the system was running. As far as these objectives, the system operated as planned.

6.3.3 Conclusions

NAVFAC ESC's system experience and data collation raised 3 major issues related to aerobically digesting ESL paint under the current design. First and foremost is cost effectiveness. The highest cost, by far, is labor. Current design and the extremely low concentration of the liquor (less than 1.5 percent paint) do not allow for an economy of scale for the system (i.e., not enough paint was digested to make the system economically viable because of the labor). It requires approximately 5 manhours per run to operate the system: loading, operation, supervision, sample collection, waste handling, replacing the activated carbon, and cleaning the probes. Treating only 60 gallons per treatment cycle makes the process cost prohibited.

Other cost demanding aspects of the system are electricity and the use of GAC for air polishing. Similarly to labor, electricity costs do not change whether the system can process 60 gallons of paint or 600 gallons of paint per treatment cycle. Therefore, the throughput of paint is too low to keep the costs of electricity more economically feasible. Unlike the fixed cost of electricity, GAC usage is dependent upon loading and can be significantly reduced by improving

degradation of the organic material. If TTO can be met by degradation alone, this would eliminate the cost of GAC for polishing the water phase prior to discharge. This can apply also to the biofilters because the more efficiently they work, the less GAC that will be needed to polish the air stream. Based upon this study, a minimum of 90 percent efficiency would be required to make this part of the system cost effective.

Other overall issues of treatment were the inability to adequately emulsify the paint to provide surface area for biological digestion and the lack of degradation. Redesign of the shearing process would be required to enhance biological degradation. Operating with less paint is not an option, as discussed earlier. Throughput is already too low on a cost basis and too diluted a waste stream will not provide adequate food for the microbial population. The final major issue, achieving and measuring degradation, will require more research in the water and solids phase.

7.0 COST ASSESSMENT

7.1 COST MODEL

Currently, ESL paint is disposed of off-site using DRMO at a cost of $1.10 per pound for bulk rate, equating to approximately $9.19 per gallon. Pearl Harbor activity disposal charges are $18.90 per gallon for hazardous waste and $15.85 per gallon for nonhazardous waste. The additional cost is to maintain permitting and to help pay material handling and storage costs. Cost comparison is based on DRMO disposal costs because these are the costs the system will be competing against. This paint is eventually shipped off island and incinerated in the continental United States. There are liabilities associated with shipping hazardous waste off island; therefore, onsite treatment is preferred. Biological treatment of solvent-based paint is a new approach that has not been fully proven to date. Therefore, the cost of biologically treating ESL paint onsite will be compared to off-site disposal using DRMO.

Organizations that assisted in gathering costs for this effort are NAVFAC Engineering Service Center, Naval Base Pearl Harbor, WRI, Inc., Santa Barbara Applied Research, Inc. (SBAR), and Biorem, Inc. NAVFAC Engineering Service Center provided developmental and regulatory costs, Naval Base Pearl Harbor provided handling and disposal costs, WRI provided costs for equipment and installation. Santa Barbara Applied Research provided estimates on reactor tanks and shipping, and Biorem was in charge of the biofiltration system costing.

Installation costs include planning, development, drawing preparation, capital costs, shipping, installation, and regulatory negotiations. Capital costs include acquisition of equipment and ancillary and supply costs. Site preparation costs include utilities and any modifications made to existing infrastructure. Operation and maintenance costs include manpower (operation and supervision), replacement parts, consumables (e.g., nutrients), equipment calibration, sampling, energy requirements, analytical work, and any waste handling and disposal. Although the routine operation of the system will not require significant labor, operation during the demonstration required additional labor associated with sampling, analysis and reporting. The analytical costs associated with the sampling during the demonstration project was tracked and used to estimate analytical costs associated with future routine operation.

7.2 COST ANALYSIS AND COMPARISON

Table 7-1 lists the development and capital costs for the installation of the system. The table breaks down specifically the development costs, site-preparation costs, equipment costs, and installation costs. Table 7-2 lists the costs specific to the DEM/VAL.

Table 7-1. Total system costs.

Category	Sub categories	Sub-sub categories	Cost
Development	Site selection		$1,000.00
	Site drawings		$25,000.00
	System drawings		$100,000.00
	Regulatory negotations		$100,000.00

Table 7-1. Total system costs - Continued.

Category	Sub categories	Sub-sub categories	Cost
Site Preparation	Pad		$25,000.00
	Utilities		$15,000.00
Capital costs	Equipment	Reactor (Cone bottom) 5000 gallons	$30,000.00
		Mixing Tank plus stand	$14,000.00
		Can Crusher	$28,000.00
		Humidifier Water Tank	$8,000.00
		Humidifier Water Transfer Tank	$10,000.00
		Mixers	$7,500.00
		Homogenizing Pumps (2)	$20,000.00
		Biofilter system	$60,000.00
		Activated Carbon Water	$23,000.00
		Activated Carbon Air	$15,000.00
		Blower	$4,500.00
		Reactor Transfer Tank	$6,500.00
		Acid and Base addition System	$4,000.00
		Nutrient addition system	$1,700.00
		Control Panel	$16,500.00
		Piping	$25,000.00
		Air tubing	$250.00
		Electrical (Wiring, conduit, etc.)	$10,000.00
		Filter Press	$20,000.00
		Auger	$2,500.00
		Cyclone separator	$1,500.00
		Valves (Manual)	$2,500.00
		Valves (8 air actuated)	$12,000.00
		Air Compressor	$2,500.00
		Air monitoring Equipment	$7500,00
		Total Equipment Cost	**$324,950.00**
	Shipping		$15,000.00
	Installation		$25,000.00
	Manual Preparation		$20,000.00
		Total System Cost	**$658,450.00**

Table 7-2. Extra DEM/VAL costs.

Category	Sub categories	Sub-sub categories	Cost
DEM/VAL costs only	Labor	Sampling	$303.00
		Pearl Harbor Analysis	$500.00
		Reporting	$27,000.00
	Analytical costs		$82,000.00
		Total DEM/VAL Add'l Costs	**$109,803.00**

Table 7-3 lists the costs for the few parts that will require replacement throughout the system's life cycle. Table 7-4 shows the operation and maintenance (O&M) costs based on the DEM/VAL VOC results in the biofiltration system, and table 7-5 is the O&M costs based on a biofiltration system that is running at 90 percent efficiency.

Table 7-3. Equipment replacement costs for life of the paint treatment system.

Part	Cost	Life Cycle (yrs)	No. Replacements Based on a 15-Year Facility	Life Cycle Cost
Blower	$4,500.00	10	1	$4,500.00
Air Compressor	$2,500.00	10	1	$2,500.00
Pump	$12,000.00	10	1	$12,000.00
Pump	$8,000.00	10	1	$8,000.00
Probes	$2,000.00	1	15	$30,000.00
			Total	**$57,000.00**

Table 7-4. Operational costs based on DEM/VAL conditions.

Type	Condition	Amount	Unit Cost	Time (hrs)	Total Cost / 24 hrs	Total Cost for 4 day run	Cost / Gal Paint
Electricity	System's total HP = 23.25	17.34 K watts	$0.17/kwh	24	$71.19	$284.75	$4.75
Water	Volume required per run per train	2,000 gal per run	$2.02/K-gal	N/A	N/A	N/A	$0.07
Acid	For pH control	2 gals	$3.00/gal	N/A	N/A	$6.00	$0.10
GAC-Air	GAC required for polishing air based on DEM/VAL data	7.0 lb per day	$5.50/lb	N/A	$38.85	$155.39	$2.59
GAC-Water	GAC required for polishing water per DEM/VAL data	0.005267 lbs/gal water	$5.50/lb	N/A	N/A	$57.95	$0.97
Nutrients	N-Z Amine	8.25 lbs/ run	$10.55/lb	N/A	N/A	$87.04	$1.45
	Yeast Extract	8.25 lbs/ run	$4.45/lb	N/A	N/A	$36.71	$0.61
	Urea	23.05 lbs/ run	$0.41/lb	N/A	N/A	$9.43	$0.16
	Phosphate	11.15 lbs/ run	$0.26/lb	N/A	N/A	$2.91	$0.05
Disposal	Non-hazardous sludge	698.00 lbs	$0.45/lb	N/A	N/A	$314.10	$1.42
Labor	Manpower	5 hrs	$75.00	N/A	N/A	$375.00	$6.25
Life Cycle Costs	Equipment replacement	N/A	N/A	N/A	N/A	N/A	$1.22
						Total operational cost / gallon paint	**$19.63**

Table 7-5. Operational costs based on ideal biofilter performance.

Type	Condition	Amount	Units	Unit Cost	Units	Time (hrs)	Total Cost / 24 hrs	Total Cost for a 4 Day Run	Cost / Gal Paint
Electricity	System's total HP = 23.25	17.34	K watts	$0.17	kwh	24	$71.19	$284.75	$4.75
Water	Volume of water required per run per train	2000	gal / run	$2.02	K-gal	N/A	N/A	N/A	$0.07
Acid	For pH control	2	gal	$3.00	gal	N/A	N/A	$6.00	$0.10
GAC-Air	GAC required for polishing air based on 90% removal efficiency for biofilters	1.65	lb / d	$5.50	lb	N/A	$9.05	$36.21	$0.60
GAC-Water	GAC required for polishing water based on DEM/VAL data	0.00527	lb /gal-water	$5.50	lb	N/A	N/A	$57.95	$0.97
Nutrients	N-Z Amine	8.25	lbs / run	$10.55	lb	N/A	N/A	$87.04	$1.45
	Yeast Extract	8.25	lbs / run	$4.45	lb	N/A	N/A	$36.71	$0.61
	Urea	23.05	lbs / run	$0.41	lb	N/A	N/A	$9.43	$0.16
	Phosphate	11.15	lbs / run	$0.26	lb	N/A	N/A	$2.91	$0.05
Disposal	Non-hazardous sludge	698.00	lbs	$0.45	lb	N/A	N/A	$314.10	$1.42
Labor	Requires 5 man hours	5	hrs	$75.00	$$	N/A	N/A	$375.00	$6.25
Life Cycle Costs	Equipment replacement	N/A	N/A	N/A	N/A	N/A	N/A	N/A	$1.22
								Total operational cost / gallon paint	$17.61

No facility capital costs are calculated because the project did not propose to build a facility or building. System capital costs and life-cycle costs are based on the assumption that the system would be installed in a preexisting structure within an operating waste treatment facility.

All O&M costs (tables 7-4 and 7-5), except for disposal, are based on a 4-day, 60-gallon treatment run. Labor for operation, supervision, sample collection, and waste handling was estimated to average about 5 manhours per run. Disposal volume is based on DEM/VAL results. All test run results that were used for analyzing were completed in system B. Two hundred twenty-three gallons of treated paint yielded approximately 220 gallons of wet sludge. Analysis of the wet sludge showed it was approximately 38 percent solids. Because the wet sludge was never weighed and the specific gravity of the paints was all approximately 1, it was decided to use this figure for the wet sludge. Based upon this assumption, this would yield 698 pounds of sludge for disposal after dewatering. It could be argued that the specific gravity of the sludge is higher than 1, increasing the pounds of sludge requiring disposal. However, for this demonstration it will have little bearing. In addition, though this system was not outfitted with an auger, which would dramatically reduce the cost of sludge handling, the costs were calculated based on a reactor with appropriate de-sludging capability.

As discussed in Section 6.0, the operation of this system is the single largest contributing factor to the excessive life-cycle cost. The issue stems from two major sources as indicated in tables 7-4 and 7-5: electricity and labor. As indicated in tables 6-3 and 6-4, the cost of disposing of hazardous waste by DRMO (in this case, paint) is $9.19 per gallon. In order for the system to be cost effective, the operational and maintenance costs would have to be less than this figure. However, as it stands, it's at $19.63 and $17.61 for DEM/VAL conditions and for operations when the biofilter efficiency is at 90 percent, respectively. Labor and electricity alone exceeds the $9.19 threshold. While electricity might be less expensive elsewhere, the cost to provide energy to the system is still too expensive with current fuel and energy costs.

In summary, without improving throughput of paint, the process can never be cost effective. As stated before, factors contributing to the elevated costs, in order of significance, are throughput [affects fixed costs (i.e., labor, electricity)], KWATT-H cost, activated carbon, N-Z amine, and degradation efficiency of the paint. In order to have a chance of making this process cost effective, the current system throughput would have to be increased from 60 gallons to a minimum of 200 gallons per treatment cycle. This would dramatically reduce the fix costs, such as labor and electricity. After this has been accomplished, degradation needs to be maximized to the extent possible in both phases (i.e., air and water) to reduce costs associated with activated carbon use and reduce total sludge disposal costs. Recycling the water after treatment to the extent possible will also reduce the amount of carbon required. Finally, the requirement for N-Z amine needs to be looked at very closely. At current dosing, this nutrient alone contributes $1.45 per gallon of paint, which is significant. There are great challenges ahead that have to be overcome before biological treatment of solvent-based paint can become economically viable.

8.0 IMPLEMENTATION ISSUES

The scale-up from pilot to DEM/VAL proved to be premature. Results and information were inconclusive and lacking in the pilot report, and after the DEM/VAL, much is still unknown about the process. The majority of the work and research during the DEM/VAL should have been completed on the pilot scale. Moving a treatment system to this scale requires a much better understanding of the process. Because of this, major operational issues were encountered and discussed in previous sections of this report. If the process were to become economically viable, there would be two major implementation issues to contend with - permitting and system operators.

First, a Part B permit would be required. For installations that already possess a Part B permit, modification to their existing permit would be required. How long this would take and the exact costs associated with this process are unknown. Because biological treatment of solvent-based paint has never been done before, it is possible that additional requirements that do not currently exist may be imposed upon the process due to the complex organic chemistries associated with this waste. For facilities that are not operating under a Part B permit, a new permit would be required, and this would definitely require additional time.

Secondly, personnel staffing requirements would need to be established. This system is a delicate process, requiring a highly skilled level of operators to ensure its success. Substantial training would be required and individuals in charge of the system would have to be proven, highly-motivated individuals. Although the system is self-sufficient when running properly, an upset in the process can quickly become a crisis, and personnel must be able to have the knowledge to act quickly and correctly.

8.1 LESSONS LEARNED

Because of operational issues that became evident during the various runs, revisions to the SBR system have been proposed. The revised SBR proposal is shown in figure 8-1. Each of the revisions will be discussed below.

One of the most critical issues encountered during the demonstration was the insufficient emulsification of the paint in the mixing tank. It became clear that the pumps supplied with the system were incapable of shearing the paint and, therefore, degradation of the paint was adversely affected. Pumps designed to shear liquids with relatively high viscosity would be required. These pumps would be used to shear the paint in the mixing tank as well as in the reactor, as shown in figure 8-1.

The reaction tanks also had some deficiencies associated with them. Based upon the solids found in the reactor, settable solids will be formed regardless of the efficiency of the degradation process. The metals found in the paints will not be degraded and, therefore, will eventfully settle to the bottom of the reactors. Unfortunately, as designed, there is not a simple way of removing the solids accumulating at the bottom of the reactors without having to empty the reactors first. Then someone has to enter the reactor to remove the solids. From an operational perspective, this situation is unacceptable. The reactors should have been configured with a cone bottom retrofitted with an auger. This type of setup would allow an operator to remove solids that settle

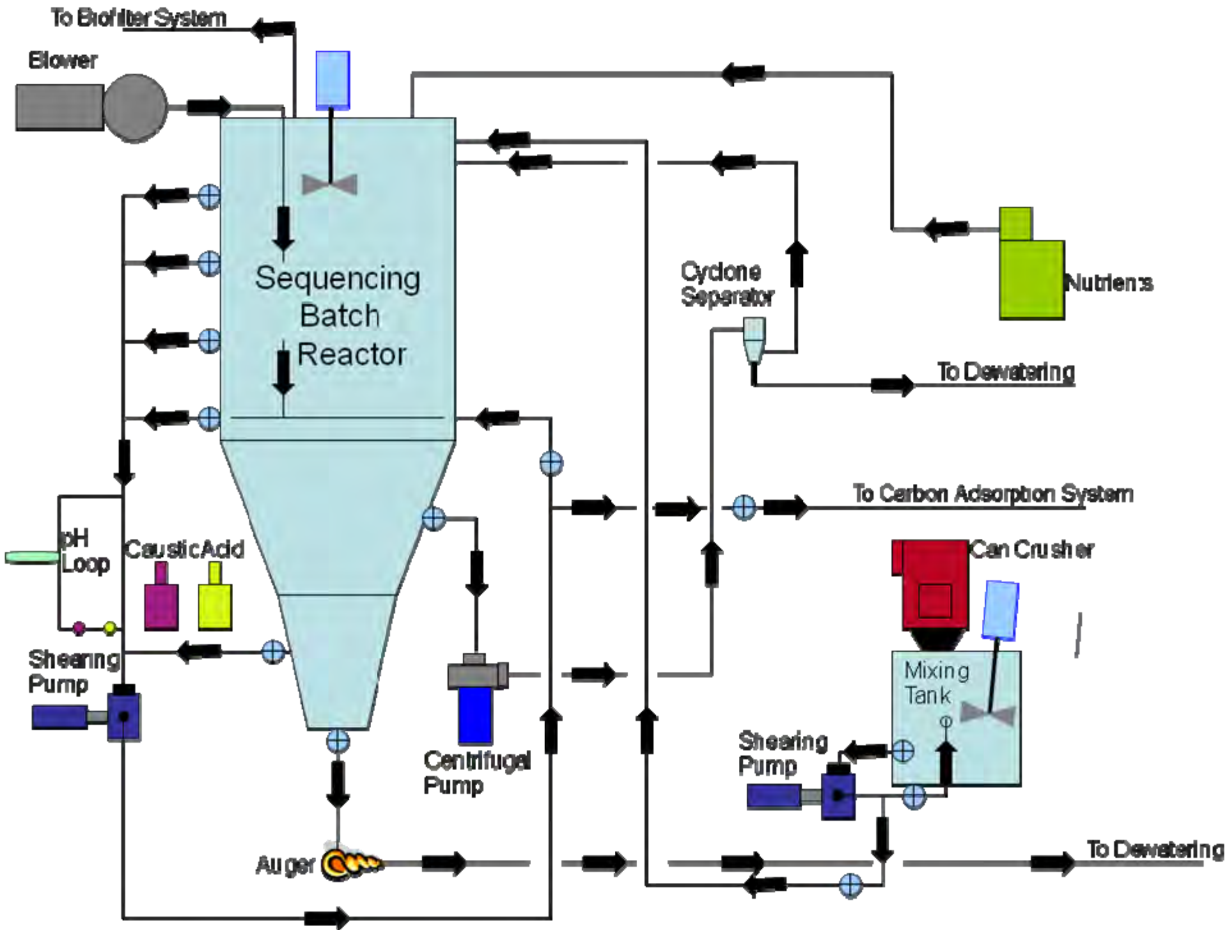


Figure 8-1. Revised SBR biological treatment system for ESL solvent-based paint system.

to the bottom of the reactor without having to empty the vessel or having to climb inside the vessel. In addition, one could remove the solids during operation, if desired. This would dramatically reduce the labor required to run such a system.

A cyclone separator would be a nice addition to the system. We found the bacteria hard to concentrate and never really reached a high enough concentration in the reactor to be considered satisfactory. The cyclone separator could be used to remove bacteria from the reactor when required or to concentrate the bacteria without having to wait for the bacteria to settle, which can take up to 24 hours or more.

Finally, not shown in the figure, is an additional tank. Having an additional tank would allow the system to recycle the water several times before having to dispose of it. This would reduce dramatically the use of activated carbon to remove residual organics left in the water phase. It also would reduce the amount of nutrients used because the unused nutrients would be recycled back to the reactor for another treatment cycle.

All of the items mentioned above would reduce dramatically the labor costs and increase the efficiency of the system. It is anticipated that labor costs alone could be reduced by a factor of 3 to 4 if these items were incorporated. In addition, Hawaii has one of the most expensive electricity costs within the US. If the demonstration had been conducted within the contiguous US, this cost could have been reduced by at least 50 percent.

With this being said, plans are in place to improve the current system to the extent possible. NAVFAC ESC received funding from Naval Base Hawaii to implement some of the items mentioned above. In addition, further testing will be conducted in order to improve degradation of the paints in order to reduce sludge generated from the system. After these modifications have been incorporated and testing completed, the system will be put online. Naval Base Hawaii envisions someday treating all of Hawaii’s DoD unused paints.

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APPENDIX A

POINTS OF CONTACT

POINT OF CONTACT Name	ORGANIZATION Name Address	Phone Fax Email	Role in Project
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APPENDIX B

SCHEMATIC OF BIOLOGICAL TREATMENT SYSTEM

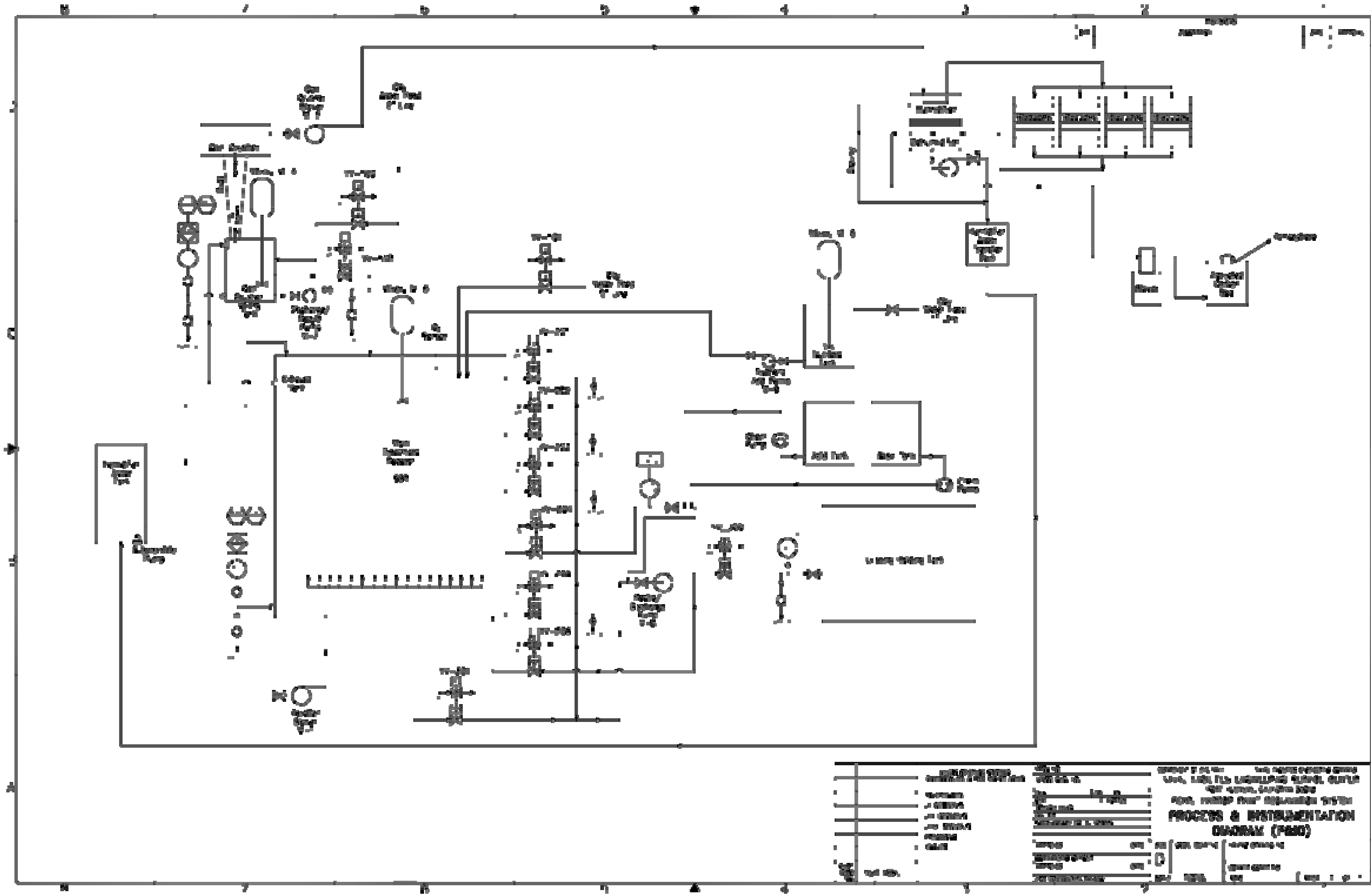

Figure B-1. Schematic drawing of the biological treatment system for expired shelf life paint.

APPENDIX C

LOADING AND GENERAL DATA

Run 1

	(lbs)
Paint	324
Phosphorus	41.6
Nitrogen	86
Yeast	7.5
N-amine	9

Date	**7/28/08**	**8/26/08**
Ammonia as Nitrogen (mg/L)	136	143
BOD (mg/L)	38	39
COD (mg/L)	381	283
Nitrogen (TKN) (mg/L)	119	110
Orthophosphate as Phosphorus (mg/L)	132	104
pH	7.68	8.07
DOC (mg/L)	68	--
TOC (mg/L)	93	73.1
Sulfate (mg/L)	--	36
Nitrate+Nitrite as Nitrogen (mg/L)	--	0.031
TSS (mg/L)	251	124

Run 2

	(lbs)
Paint	364
Phosphorus	4.1
Nitrogen	1.7
Yeast	7.5
N-amine	9

Date	**9/26/08**	**10/3/08**	**10/9/08**
Ammonia as Nitrogen (mg/L)	58.4	38.6	45.5
BOD (mg/L)	397	258	176
COD (mg/L)	1660	960	878
Nitrogen (TKN) (mg/L)	83	70	76.8
Orthophosphate as Phosphorus (mg/L)	0.18	0.18	84.9
pH	7.23	7.12	7.86
TOC (mg/L)	49.5	168	144
Sulfate (mg/L)	--	18	30.6

Nitrate+Nitrite as Nitrogen (mg/L)	0.43	0.028	0.02
Cl_2 (mg/L)	ND	ND	ND
Cr^{6+}	--	ND	ND
Settleable Solids (mg/L)	5.3	4.2	3.7
TSS (mg/L)	1140	680	616
TVS (mg/L)	1520	965	960

Run 3

	(lbs)
Paint	546
Phosphorus	24.2
Nitrogen	10.1
Yeast	7.5
N-amine	9

Date	**12/10/08**	**12/20/08**	**1/8/09**
Ammonia as Nitrogen (mg/L)	64.9	123	152
BOD (mg/L)	4070	--	42
COD (mg/L)	860.5	4090	3580
Nitrogen (TKN) (mg/L)	245	197	203
Orthophosphate as Phosphorus (mg/L)	129	115	109
pH	6.705	7.17	7.22
TOC (mg/L)	297.5	3.9	148
Sulfate (mg/L)	79	253	442
Nitrate+Nitrite as Nitrogen (mg/L)	ND	0.06	0.031
Cl_2 (mg/L)	ND	ND	ND
Cr^{6+}	0.1	ND	ND
Settleable Solids (mg/L)	--	21	12
TSS (mg/L)	3350	3620	3490
TVS (mg/L)	5290	5120	1550

Run 4

	(lbs)
Paint	662
Phosphorus	7.9
Nitrogen	38.9
Yeast	9
N-amine	7.5

Date	2/10/09	2/18/09	2/27/09
Ammonia as Nitrogen (mg/L)	507	598	499
BOD (mg/L)	1820	1030	1180
COD (mg/L)	7080	6370	3140
Nitrogen (TKN) (mg/L)	423	650	615.5
Orthophosphate as Phosphorus (mg/L)	79.2	84.3	72.7
pH	7.96	8.375	8.31
TOC (mg/L)	995	832	724
Sulfate (mg/L)	181	201	170
Nitrate+Nitrite as Nitrogen (mg/L)	0.022	0.035	0.039
Cl_2 (mg/L)	ND	ND	ND
Cr^{6+}	ND	ND	ND
Settleable Solids (mg/L)	12	15	0.8
TSS (mg/L)	2260	2280	1120
TVS (mg/L)	3040	2600	1605

Run 5

	(lbs)
Paint	401
Phosphorus	8.4
Nitrogen	41.5
Yeast	9
N-amine	7.5

Date	3/6/09	3/13/09	3/23/09
Ammonia as Nitrogen (mg/L)	857	915	802
BOD (mg/L)	6190	1420	602
COD (mg/L)	16700	12600	4700
Nitrogen (TKN) (mg/L)	1050	1310	895
Orthophosphate as Phosphorus (mg/L)	94.1	77.75	75.65
pH	8.63	8.67	8.99
TOC (mg/L)	1490	1640	619
Sulfate (mg/L)	422	730	597
Nitrate+Nitrite as Nitrogen (mg/L)	0.32	0.465	2.84
Cl_2 (mg/L)	6.3	ND	ND
Cr^{6+}	0.1425	ND	0.031
Settleable Solids (mg/L)	35	30	9.5
TSS (mg/L)	7110	7000	2510
TVS (mg/L)	8390	6100	3790

Run 6

	(lbs)
Paint	651
Phosphorus	8.4
Nitrogen	41.5
Yeast	9
N-amine	7.5

Date	5/5/09	5/6/09	5/7/09	5/8/09	5/22/09
Ammonia as Nitrogen (mg/L)	573	467	541.67	346	298
BOD (mg/L)	9000	9590	6200	3020	1500
COD (mg/L)	19300	27600	19500	17000	6035
Nitrogen (TKN) (mg/L)	848	635	685	618	466
Orthophosphate as Phosphorus (mg/L)	55.85	84	77	67.4	69.2
pH	8.72	8.13	7.84	7.79	8.18
TOC (mg/L)	1450	1590	1650	1160	1110
Sulfate (mg/L)	466	520	545	509	458
Nitrate+Nitrite as Nitrogen (mg/L)	3.67	3.5	0.025	1.17	0.05
Cl_2 (mg/L)	ND	ND	ND	ND	ND
Cr^{6+}	0.0125	0.007	0.0085	0.019	0.022
Settleable Solids (mg/L)	95.6	1000	24	17	2
TSS (mg/L)	9250	9500	10500	8450	1800
TVS (mg/L)	7750	8265	8800	6450	3295

APPENDIX D

METALS - LIQUID PHASE

	Run 1		Run 2						Run 3					
	8/26/08		9/26/08		10/3/08		10/9/08		12/10/08		12/20/08		1/8/09	
Analyte	**Result (ug/L)**	**Result (mg/L)**	**Result (ug/L)**	**Result (mg/L)**	**Result (ug/L)**	**Result (mg/L)**	**Result (ug/L)**	**Result (mg/L)**	**Result (ug/L)**	**Result (mg/L)**	**Result (ug/L)**	**Result (mg/L)**	**Result (ug/L)**	**Result (mg/L)**
Arsenic	11.5	0.0115	25	0.025	7.4	0.0074	7.9	0.0079	12.1	0.0121	12.6	0.0126	10.9	0.0109
Barium	51.4	0.0514	1380	1.38	113	0.113	99.9	0.0999	2140	2.14	1080	1.08	2700	2.7
Beryllium	0.318	0.000318	1.5	0.0015	0.085	0.000085	0.158	0.000158	2.56	0.00256	2.11	0.00211	1.79	0.00179
Cadmium	12.8	0.0128	57.5	0.0575	6.52	0.00652	6.38	0.00638	83.8	0.0838	63.7	0.0637	54.4	0.0544
Chromium	60.6	0.0606	345	0.345	25.2	0.0252	31.3	0.0313	431	0.431	364	0.364	320	0.32
Cobalt	115	0.115		0		0		0		0		0		0
Copper	630	0.63	2750	2.75	229	0.229	384	0.384	1110	1.11	1210	1.21	1080	1.08
Iron	1010	1.01		0		0		0		0		0		0
Lead	27.8	0.0278	57.5	0.0575	8.43	0.00843	15.5	0.0155	123	0.123	145	0.145	167	0.167
Manganese	34.2	0.0342	156	0.156	16.7	0.0167	16.4	0.0164	224	0.224	174	0.174	135	0.135
Mercury	0.05	0.00005	0.2	0.0002	0.05	0.00005	0.05	0.00005	0.14	0.00014	0.05	0.00005	0.05	0.00005
Nickel	42.4	0.0424	118	0.118	33.9	0.0339	38.2	0.0382	157	0.157	144	0.144	120	0.12
Selenium	0.8	0.0008	30	0.03	0.8	0.0008	1.9	0.0019	0	0	2	0.002	4	0.004
Silver	0.109	0.000109	3.5	0.0035	0.026	0.000026	0.063	0.000063	0.58	0.00058	0.26	0.000260	0.439	0.000439
Thallium	0.806	0.000806	10	0.01		0		0		0		0		0
Tin		0	110	0.11	0.11	0.00011	0.29	0.00029	50.8	0.0508	3.15	0.00315	49.4	0.0494
Titanium		0		0	107	0.107	87.6	0.0876	1810	1.81	475	0.475	1690	1.69
Vanadium	426	0.426		0		0		0		0		0		0
Zinc	445	0.445	3310	3.31	327	0.327	394	0.394	4750	4.75	3160	3.16	3160	3.16
Heavy metals totals	**2868.783**	**2.868783**	**8354.2**	**8.3542**	**875.221**	**0.875221**	**1083.641**	**1.083641**	**10894.98**	**10.89498**	**6835.87**	**6.83587**	**9492.979**	**9.492979**

	Run 4								Run 5					
	2/10/09		2/18/09		2/27/09		2/27/2009 Decant		3/6/09		3/13/09		3/23/09	
Analyte	**Result (ug/L)**	**Result (mg/L)**	**Result (ug/L)**	**Result (mg/L)**	**Result (ug/L)**	**Result (mg/L)**	**Result (ug/L)**	**Result (mg/L)**	**Result (ug/L)**	**Result (mg/L)**	**Result (ug/L)**	**Result (mg/L)**	**Result (ug/L)**	**Result (mg/L)**
Arsenic	12	0.012	11.5	0.0115	12.15	0.01215	11.3	0.0113	18.75	0.01875	17.6	0.0176	10.8	0.0108
Barium	825	0.825	832	0.832	283.5	0.2835	188	0.188	5580	5.58	3360	3.36	975.5	0.9755
Beryllium	2.19	0.00219	2.05	0.00205	1.265	0.001265	1.25	0.00125	3.205	0.003205	2.975	0.002975	0.5555	0.0005555
Cadmium	66.6	0.0666	59.7	0.0597	38.25	0.03825	36.1	0.0361	99.55	0.09955	88.3	0.0883	16.46666667	0.016466667
Chromium	377	0.377	344	0.344	243	0.243	244	0.244	605	0.605	486	0.486	125.5	0.1255
Cobalt		0		0		0		0		0		0		0
Copper	1350	1.35	1430	1.43	1485	1.485	1510	1.51	2485	2.485	2490	2.49	3725	3.725
Iron		0		0	1485	1.485		0		0		0		0
Lead	180	0.18	165	0.165	105.5	0.1055	97.9	0.0979	265.5	0.2655	269.5	0.2695	78.95	0.07895
Manganese	156	0.156	137	0.137	90.5	0.0905	92	0.092	462.5	0.4625	351	0.351	79	0.079
Mercury	0.2	0.0002	ND	--	ND	--	ND	--	ND	--	ND	--	ND	--
Nickel	156	0.156	146	0.146	131.5	0.1315	120	0.12	226	0.226	220.5	0.2205	99.05	0.09905
Selenium	4	0.004	ND	--	ND	--	ND	--	ND	--	2.95	0.00295	ND	--
Silver	4.01	0.00401	3.53	0.00353	2.27	0.00227	1.46	0.00146	11.65	0.01165	1.885	0.001885	0.632	0.000632
Thallium		0		0	1485	1.485		0		0		0		0
Tin	57.6	0.0576	42.4	0.0424	73	0.073	71.4	0.0714	139.5	0.1395	112.5	0.1125	47.9	0.0479
Titanium	600	0.6	598	0.598	346.5	0.3465	372	0.372	2300	2.3	1320	1.32	452.5	0.4525
Vanadium		0		0	1485	1.485		0		0		0		0
Zinc	3230	3.23	3010	3.01	2100	2.1	2150	2.15	5675	5.675	4570	4.57	1965	1.965
Heavy metals totals	**7020.6**	**7.0206**	**6781.18**	**6.78118**	**9367.435**	**9.367435**	**4895.41**	**4.89541**	**17871.655**	**17.871655**	**13293.21**	**13.29321**	**7576.854167**	**7.576854167**

	Run 6									
	5/5/09		5/6/09		5/7/09		5/8/09		5/22/09	
Analyte	Result (ug/L)	Result (mg/L)	Result (ug/L)	Result (mg/L)	Result (ug/L)	Result (mg/L)	Result (ug/L)	Result (mg/L)	Result (ug/L)	Result (mg/L)
Arsenic	16.35	0.01635	18	0.018	16.75	0.01675	16.8	0.0168	13.1	0.0131
Barium	11100	11.1	12100	12.1	11450	11.45	9610	9.61	1300	1.3
Beryllium	0.3025	0.000303	0.679	0.000679	0.713	0.000713	0.934	0.000934	0.482	0.000482
Cadmium	10.75	0.01075	23.6	0.0236	23.55	0.02355	22.3	0.0223	14.7	0.0147
Chromium	451	0.451	388	0.388	572	0.572	534	0.534	288	0.288
Cobalt		0		0		0		0		0
Copper	2810	2.81	2870	2.87	3000	3	2740	2.74	2080	2.08
Iron		0		0		0		0		0
Lead	2910	2.91	2930	2.93	3095	3.095	2550	2.55	1470	1.47
Manganese	14350	14.35	13000	13	17500	17.5	14400	14.4	1590	1.59
Mercury	0.08	0.00008	0.12	0.00012	ND	--	0.04	0.00004	ND	--
Nickel	157	0.157	201	0.201	196.5	0.1965	193	0.193	149	0.149
Selenium	ND	--	ND	--	ND	--	ND	--	ND	--
Silver	6.415	0.006415	4.71	0.00471	3.625	0.003625	2.88	0.00288	0.694	0.000694
Thallium		0		0		0		0		0
Tin	1590	1.59	1590	1.59	1510	1.51	1350	1.35	263	0.263
Titanium	1355	1.355	1180	1.18	1675	1.675	1280	1.28	286	0.286
Vanadium		0		0		0		0		0
Zinc	8345	8.345	8450	8.45	11950	11.95	9940	9.94	9200	9.2
Heavy metals totals	**43101.9**	**43.1019**	**42756.11**	**42.75611**	**50993.14**	**50.993138**	**42639.954**	**42.639954**	**16654.976**	**16.654976**

APPENDIX E

VOC'S - LIQUID PHASE

	Run 1		Run 2						Run 3					
	8/26/08		9/26/08		10/3/08		10/9/08		12/10/08		12/20/08		1/8/09	
Analyte Name	**Result (ug/L)**	**Results (mg/L)**	**Result (ug/L)**	**Results (mg/L)**	**Result (ug/L)**	**Results (mg/L)**	**Result (ug/L)**	**Results (mg/L)**	**Result (ug/L)**	**Results (mg/L)**	**Result (ug/L)**	**Results (mg/L)**	**Result (ug/L)**	**Results (mg/L)**
Dichlorodifluoromethane	ND	--	ND	--	ND	--	ND	--	ND	--	ND	--	ND	--
Chloromethane	0.12	0.00012	ND	--	3.2	0.0032	ND	--	ND	--	2.5	0.0025	0.37	0.00037
Vinyl Chloride	ND	--	ND	--	ND	--	ND	--	ND	--	ND	--	ND	--
Bromomethane	ND	--	ND	--	ND	--	2.00	0.002	ND	--	ND	--	ND	--
Chloroethane	ND	--	ND	--	ND	--	ND	--	ND	--	ND	--	ND	--
Trichlorofluoromethane	ND	--	ND	--	ND	--	ND	--	ND	--	ND	--	ND	--
Acetone	13	0.013	ND	--	19	0.019	ND	--	640	0.64	26	0.026	3	0.003
1,1-Dichloroethene	ND	--	ND	--	ND	--	ND	--	ND	--	ND	--	ND	--
Carbon Disulfide	ND	--	ND	--	0.05	0.00005	ND	--	ND	--	0.38	0.00038	0.22	0.00022
Methylene Chloride	ND	--	ND	--	ND	--	ND	--	ND	--	ND	--	ND	--
trans-1,2-Dichloroethene	ND	--	ND	--	ND	--	ND	--	ND	--	ND	--	ND	--
1,1-Dichloroethane	ND	--	ND	--	ND	--	ND	--	ND	--	ND	--	ND	--
2-Butanone (MEK)	180	0.18	ND	--	16	0.016	ND	--	ND	--	ND	--	ND	--
2,2-Dichloropropane	ND	--	ND	--	ND	--	ND	--	ND	--	ND	--	ND	--
cis-1,2-Dichloroethene	ND	--	ND	--	ND	--	ND	--	ND	--	ND	--	ND	--
Chloroform	ND	--	ND	--	ND	--	ND	--	ND	--	ND	--	0.05	0.00005
Bromochloromethane	ND	--	ND	--	ND	--	ND	--	ND	--	ND	--	ND	--
1,1,1-Trichloroethane (TCA)	ND	--	ND	--	ND	--	ND	--	ND	--	ND	--	ND	--
1,1-Dichloropropene	ND	--	ND	--	ND	--	ND	--	ND	--	ND	--	ND	--
Carbon Tetrachloride	ND	--	ND	--	ND	--	ND	--	ND	--	ND	--	ND	--
1,2-Dichloroethane (EDC)	ND	--	ND	--	ND	--	ND	--	ND	--	ND	--	ND	--
Benzene	ND	--	600	0.6	0.12	0.00012	ND	--	ND	--	0.18	0.00018	ND	--
Trichloroethene (TCE)	ND	--	ND	--	ND	--	ND	--	ND	--	ND	--	ND	--
1,2-Dichloropropane	ND	--	ND	--	ND	--	ND	--	ND	--	ND	--	ND	--
Bromodichloromethane	ND	--	ND	--	ND	--	ND	--	ND	--	ND	--	ND	--
Dibromomethane	ND	--	ND	--	ND	--	ND	--	ND	--	ND	--	ND	--
2-Hexanone	23	0.023	ND	--	ND	--	ND	--	ND	--	ND	--	ND	--
cis-1,3-Dichloropropene	ND	--	ND	--	ND	--	ND	--	ND	--	ND	--	ND	--
Toluene	ND	--	500	0.5	1.4	0.0014	1.50	0.0015	3800	3.8	73	0.073	26	0.026
trans-1,3-Dichloropropene	ND	--	ND	--	ND	--	ND	--	ND	--	ND	--	ND	--
1,1,2-Trichloroethane	ND	--	ND	--	ND	--	ND	--	ND	--	ND	--	ND	--
4-Methyl-2-pentanone (MIBK)	24	0.024	ND	--	ND	--	ND	--	ND	--	ND	--	ND	--
1,3-Dichloropropane	ND	--	ND	--	ND	--	ND	--	ND	--	ND	--	ND	--
Tetrachloroethene (PCE)	ND	--	ND	--	ND	--	ND	--	ND	--	ND	--	ND	--
Dibromochloromethane	ND	--	ND	--	ND	--	ND	--	ND	--	ND	--	ND	--
1,2-Dibromoethane (EDB)	ND	--	ND	--	ND	--	ND	--	ND	--	ND	--	ND	--
Chlorobenzene	ND	--	ND	--	ND	--	ND	--	ND	--	ND	--	ND	--
1,1,1,2-Tetrachloroethane	ND	--	ND	--	ND	--	ND	--	ND	--	ND	--	ND	--
Ethylbenzene	0.05	0.00005	28000	28	130	0.13	92.00	0.092	8700	8.7	260	0.26	120	0.12
m,p-Xylenes	0.18	0.00018	21000	21	130	0.13	91.00	0.091	12000	12	350	0.35	160	0.16
o-Xylene	0.06	0.00006	13000	13	88	0.088	51.00	0.051	11000	11	310	0.31	130	0.13
Styrene	ND	--	ND	--	ND	--	ND	--	ND	--	ND	--	ND	--
Bromoform	ND	--	ND	--	ND	--	ND	--	ND	--	ND	--	ND	--
Isopropylbenzene	ND	--	11000	11	51	0.051	28.00	0.028	1000	1	40	0.04	26	0.026
1,1,2,2-Tetrachloroethane	ND	--	ND	--	ND	--	ND	--	ND	--	ND	--	ND	--
1,2,3-Trichloropropane	ND	--	ND	--	ND	--	ND	--	ND	--	ND	--	ND	--
Bromobenzene	ND	--	ND	--	ND	--	ND	--	ND	--	ND	--	ND	--
n-Propylbenzene	ND	--	27000	27	79	0.079	54.00	0.054	1700	1.7	60	0.06	40	0.04
2-Chlorotoluene	ND	--	ND	--	ND	--	ND	--	ND	--	ND	--	ND	--
4-Chlorotoluene	ND	--	ND	--	ND	--	ND	--	ND	--	ND	--	ND	--
1,3,5-Trimethylbenzene	ND	--	46000	46	260	0.26	110.00	0.11	4200	4.2	190	0.19	100	0.1
tert-Butylbenzene	ND	--	ND	--	0.16	0.00016	ND	--	ND	--	0.08	0.00008	0.05	0.00005
1,2,4Trimethylbenzene	ND	--	190000	190	1000	1	410.00	0.41	21000	21	700	0.7	380	0.38
sec-Butylbenzene	ND	--	1400	1.4	4.3	0.0043	2.40	0.0024	63	0.063	2.4	0.0024	1.3	0.0013
1,3-Dichlorobenzene	ND	--	ND	--	ND	--	ND	--	ND	--	ND	--	ND	--
4-Isopropyltoluene	ND	--	1300	1.3	5.6	0.0056	2.00	0.002	55	0.055	2.2	0.0022	1.1	0.0011
1,4-Dichlorobenzene	ND	--	ND	--	ND	--	ND	--	ND	--	ND	--	ND	--
n-Butylbenzene	0.06	0.00006	1700	1.7	17	0.017	5.00	0.005	140	0.14	ND	--	ND	--
1,2-Dichlorobenzene	ND	--	ND	--	ND	--	ND	--	ND	--	ND	--	ND	--
1,2-Dibromo-3-chloropropane	ND	--	ND	--	ND	--	ND	--	ND	--	ND	--	ND	--
1,2,4-Trichlorobenzene	0.2	0.0002	ND	--	ND	--	ND	--	ND	--	ND	--	ND	--
1,2,3-Trichlorobenzene	0.13	0.00013	ND	--	ND	--	ND	--	ND	--	ND	--	ND	--
Naphthalene	0.25	0.00025	ND	--	1.9	0.0019	1.90	0.0019	35	0.035	1.2	0.0012	0.7	0.0007
Hexachlorobutadiene	ND	--	ND	--	ND	--	ND	--	ND	--	ND	--	ND	--
Dibromofluoromethane (%)		%	104	%		%		%	88	%	ND	%	ND	%
Toluene-d8 (%)		%	108	%		%		%	123	%	ND	%	ND	%
4-Bromofluorobenzene (%)		%	96	%		%		%	103	%	ND	%	ND	%
VOC Totals	**241.05**	**0.2411**	**341500**	**341.5**	**1806.73**	**1.80673**	**850.8**	**0.8508**	**64333**	**64.333**	**2017.94**	**2.01794**	**988.79**	**0.98879**

	Run 4								Run 5					
	2/10/09		2/18/09		2/27/09		2/27/2009 decant		3/6/09		3/13/09		3/23/09	
Analyte Name	**Result (ug/L)**	**Results (mg/L)**	**Result (ug/L)**	**Results (mg/L)**	**Result (ug/L)**	**Results (mg/L)**	**Result (ug/L)**	**Results (mg/L)**	**Result (ug/L)**	**Results (mg/L)**	**Result (ug/L)**	**Results (mg/L)**	**Result (ug/L)**	**Results (mg/L)**
Dichlorodifluoromethane	ND	--	ND	--	ND	--	ND	--	ND	--	ND	--	ND	--
Chloromethane	ND	--	0.35	0.00035	0.6	0.0006	0.7	0.0007	ND	--	ND	--	0.9	0.0009
Vinyl Chloride	ND	--	ND	--	ND	--	ND	--	ND	--	ND	--	ND	--
Bromomethane	ND	--	ND	--	ND	--	ND	--	ND	--	ND	--	ND	--
Chloroethane	ND	--	ND	--	ND	--	ND	--	ND	--	ND	--	ND	--
Trichlorofluoromethane	ND	--	ND	--	ND	--	ND	--	ND	--	ND	--	ND	--
Acetone	500	0.5	230	0.23	35	0.035	34	0.034	340	0.34	65	0.065	730	0.73
1,1-Dichloroethene	ND	--	ND	--	ND	--	ND	--	ND	--	ND	--	ND	--
Carbon Disulfide	0.7	0.0007	0.4	0.0004	ND	--	ND	--	ND	--	ND	--	ND	--
Methylene Chloride	ND	--	ND	--	ND	--	ND	--	ND	--	ND	--	2.4	0.0024
trans-1,2-Dichloroethene	ND	--	ND	--	ND	--	ND	--	ND	--	ND	--	ND	--
1,1-Dichloroethane	ND	--	ND	--	ND	--	ND	--	ND	--	ND	--	ND	--
2-Butanone (MEK)	1500	1.5	440	0.44	110	0.11	94	0.094	350	0.35	22	0.022	110	0.11
2,2-Dichloropropane	ND	--	ND	--	ND	--	ND	--	ND	--	ND	--	ND	--
cis-1,2-Dichloroethene	ND	--	0.5	0.0005	ND	--	ND	--	ND	--	ND	--	ND	--
Chloroform	ND	--	ND	--	ND	--	ND	--	ND	--	ND	--	ND	--
Bromochloromethane	ND	--	ND	--	ND	--	ND	--	ND	--	ND	--	ND	--
1,1,1-Trichloroethane (TCA)	ND	--	ND	--	ND	--	ND	--	ND	--	ND	--	ND	--
1,1-Dichloropropene	ND	--	ND	--	ND	--	ND	--	ND	--	ND	--	ND	--
Carbon Tetrachloride	ND	--	ND	--	ND	--	ND	--	ND	--	ND	--	ND	--
1,2-Dichloroethane (EDC)	ND	--	ND	--	ND	--	ND	--	ND	--	ND	--	ND	--
Benzene	ND	--	ND	--	2	0.002	1.8	0.0018	ND	--	ND	--	ND	--
Trichloroethene (TCE)	ND	--	ND	--	ND	--	ND	--	ND	--	ND	--	ND	--
1,2-Dichloropropane	ND	--	ND	--	ND	--	ND	--	ND	--	ND	--	ND	--
Bromodichloromethane	ND	--	ND	--	ND	--	ND	--	ND	--	ND	--	ND	--
Dibromomethane	ND	--	ND	--	ND	--	ND	--	ND	--	ND	--	ND	--
2-Hexanone	ND	--	ND	--	ND	--	ND	--	ND	--	ND	--	ND	--
cis-1,3-Dichloropropene	ND	--	ND	--	ND	--	ND	--	ND	--	ND	--	ND	--
Toluene	90	0.09	11	0.011	1200	1.2	1200	1.2	1600	1.6	49	0.049	11	0.011
trans-1,3-Dichloropropene	ND	--	ND	--	ND	--	ND	--	ND	--	ND	--	ND	--
1,1,2-Trichloroethane	ND	--	ND	--	ND	--	ND	--	ND	--	ND	--	ND	--
4-Methyl-2-pentanone (MIBK)	ND	--	ND	--	ND	--	ND	--	ND	--	ND	--	ND	--
1,3-Dichloropropane	ND	--	ND	--	ND	--	ND	--	ND	--	ND	--	ND	--
Tetrachloroethene (PCE)	ND	--	ND	--	ND	--	ND	--	ND	--	ND	--	ND	--
Dibromochloromethane	ND	--	ND	--	ND	--	ND	--	ND	--	ND	--	ND	--
1,2-Dibromoethane (EDB)	ND	--	ND	--	ND	--	ND	--	ND	--	ND	--	ND	--
Chlorobenzene	ND	--	ND	--	ND	--	ND	--	ND	--	ND	--	ND	--
1,1,1,2-Tetrachloroethane	ND	--	ND	--	ND	--	ND	--	ND	--	ND	--	ND	--
Ethylbenzene	380	0.38	47	0.047	1200	1.2	1400	1.4	4000	4	160	0.16	59	0.059
m,p-Xylenes	710	0.71	90	0.09	1500	1.5	1700	1.7	4200	4.2	250	0.25	85	0.085
o-Xylene	2500	2.5	410	0.41	1400	1.4	1500	1.5	3200	3.2	270	0.27	70	0.07
Styrene	ND	--	ND	--	ND	--	ND	--	ND	--	ND	--	ND	--
Bromoform	ND	--	ND	--	ND	--	ND	--	ND	--	ND	--	ND	--
Isopropylbenzene	110	0.11	11	0.011	120	0.12	140	0.14	370	0.37	35	0.035	15	0.015
1,1,2,2-Tetrachloroethane	ND	--	ND	--	ND	--	ND	--	ND	--	ND	--	ND	--
1,2,3-Trichloropropane	ND	--	ND	--	ND	--	ND	--	ND	--	ND	--	ND	--
Bromobenzene	ND	--	ND	--	ND	--	ND	--	ND	--	ND	--	ND	--
n-Propylbenzene	130	0.13	15	0.015	160	0.16	220	0.22	850	0.85	91	0.091	29	0.029
2-Chlorotoluene	ND	--	ND	--	ND	--	ND	--	ND	--	ND	--	ND	--
4-Chlorotoluene	ND	--	ND	--	ND	--	ND	--	ND	--	ND	--	ND	--
1,3,5-Trimethylbenzene	3300	3.3	1000	1	1100	1.1	1300	1.3	2400	2.4	630	0.63	93	0.093
tert-Butylbenzene	1.6	0.0016	ND	--	0.6	0.0006	ND	--	ND	--	ND	--	ND	--
1,2,4Trimethylbenzene	4400	4.4	320	0.32	2900	2.9	3500	3.5	9700	9.7	ND	--	330	0.33
sec-Butylbenzene	44	0.044	11	0.011	16	0.016	18	0.018	38	0.038	22	0.022	2.5	0.0025
1,3-Dichlorobenzene	ND	--	ND	--	ND	--	ND	--	ND	--	ND	--	ND	--
4-Isopropyltoluene	70	0.07	36	0.036	28	0.028	30	0.03	43	0.043	29	0.029	2.6	0.0026
1,4-Dichlorobenzene	ND	--	ND	--	ND	--	ND	--	ND	--	ND	--	ND	--
n-Butylbenzene	ND	--	ND	--	ND	--	ND	--	ND	--	ND	--	ND	--
1,2-Dichlorobenzene	ND	--	ND	--	ND	--	ND	--	ND	--	ND	--	ND	--
1,2-Dibromo-3-chloropropane	ND	--	ND	--	ND	--	ND	--	ND	--	ND	--	ND	--
1,2,4-Trichlorobenzene	ND	--	ND	--	ND	--	ND	--	ND	--	ND	--	ND	--
1,2,3-Trichlorobenzene	ND	--	ND	--	ND	--	ND	--	ND	--	ND	--	ND	--
Naphthalene	63	0.063	50	0.05	44	0.044	44	0.044	40	0.04	66	0.066	23	0.023
Hexachlorobutadiene	ND	--	ND	--	ND	--	ND	--	ND	--	ND	--	ND	--
Dibromofluoromethane (%)		%	91	%	ND	%	89	%	103	%	100	%	92	%
Toluene-d8 (%)		%	96	%	ND	%	95	%	108	%	109	%	94	%
4-Bromofluorobenzene (%)		%	92	%	ND	%	87	%	100	%	99	%	92	%
VOC Totals	**13799.3**	**13.799**	**2951.3**	**2.6723**	**9816.2**	**9.8162**	**11182.5**	**11.1825**	**27131**	**27.131**	**1689**	**1.689**	**1563.4**	**1.5634**

	Run 6									
	5/5/09		5/6/09		5/7/09		5/8/09		5/22/09	
Analyte Name	**Result (ug/L)**	**Results (mg/L)**	**Result (ug/L)**	**Results (mg/L)**	**Result (ug/L)**	**Results (mg/L)**	**Result (ug/L)**	**Results (mg/L)**	**Result (ug/L)**	**Results (mg/L)**
Dichlorodifluoromethane	ND	--	ND	--	ND	--	ND	--	ND	--
Chloromethane	1.1	0.0011	ND	--	0.35	0.00035	2.1	0.0021	ND	--
Vinyl Chloride	ND	--	ND	--	ND	--	ND	--	ND	--
Bromomethane	ND	--	ND	--	ND	--	ND	--	ND	--
Chloroethane	ND	--	ND	--	ND	--	ND	--	ND	--
Trichlorofluoromethane	ND	--	ND	--	ND	--	ND	--	ND	--
Acetone	430	0.43	620	0.62	1600	1.6	1500	1.5	920	0.92
1,1-Dichloroethene	ND	--	ND	--	ND	--	ND	--	ND	--
Carbon Disulfide	ND	--	ND	--	0.55	0.00055	2.6	0.0026	ND	--
Methylene Chloride	ND	--	ND	--	ND	--	ND	--	ND	--
trans-1,2-Dichloroethene	ND	--	ND	--	ND	--	ND	--	ND	--
1,1-Dichloroethane	ND	--	ND	--	ND	--	ND	--	ND	--
2-Butanone (MEK)	30000	30	37000	37	29000	29	24000	24	9000	9
2,2-Dichloropropane	ND	--	ND	--	ND	--	ND	--	ND	--
cis-1,2-Dichloroethene	ND	--	ND	--	ND	--	ND	--	ND	--
Chloroform	2.6	0.0026	ND	--	ND	--	ND	--	ND	--
Bromochloromethane	ND	--	ND	--	ND	--	ND	--	ND	--
1,1,1-Trichloroethane (TCA)	ND	--	ND	--	ND	--	ND	--	ND	--
1,1-Dichloropropene	ND	--	ND	--	ND	--	ND	--	ND	--
Carbon Tetrachloride	0.5	0.0005	ND	--	ND	--	ND	--	ND	--
1,2-Dichloroethane (EDC)	ND	--	ND	--	ND	--	ND	--	ND	--
Benzene	130	0.13	100	0.1	9.1	0.0091	13	0.013	5.1	0.0051
Trichloroethene (TCE)	ND	--	ND	--	ND	--	ND	--	ND	--
1,2-Dichloropropane	ND	--	ND	--	ND	--	ND	--	ND	--
Bromodichloromethane	ND	--	ND	--	ND	--	ND	--	ND	--
Dibromomethane	ND	--	ND	--	ND	--	ND	--	ND	--
2-Hexanone	ND	--	ND	--	ND	--	ND	--	ND	--
cis-1,3-Dichloropropene	ND	--	ND	--	ND	--	ND	--	ND	--
Toluene	1900	1.9	2300	2.3	19	0.019	3.2	0.0032	5.7	0.0057
trans-1,3-Dichloropropene	ND	--	ND	--	ND	--	ND	--	ND	--
1,1,2-Trichloroethane	ND	--	ND	--	ND	--	ND	--	ND	--
4-Methyl-2-pentanone (MIBK)	240	0.24	ND	--	ND	--	ND	--	ND	--
1,3-Dichloropropane	ND	--	ND	--	ND	--	ND	--	ND	--
Tetrachloroethene (PCE)	ND	--	ND	--	ND	--	ND	--	ND	--
Dibromochloromethane	ND	--	ND	--	ND	--	ND	--	ND	--
1,2-Dibromoethane (EDB)	ND	--	ND	--	ND	--	ND	--	ND	--
Chlorobenzene	0.8	0.0008	5.5	0.0055	ND	--	1.7	0.0017	ND	--
1,1,1,2-Tetrachloroethane	31	0.031	ND	--	ND	--	ND	--	ND	--
Ethylbenzene	1200	1.2	1500	1.5	67	0.067	2.7	0.0027	5.2	0.0052
m,p-Xylenes	3800	3.8	4900	4.9	320	0.32	11	0.011	19	0.019
o-Xylene	1600	1.6	2100	2.1	200	0.2	7.1	0.0071	8.6	0.0086
Styrene	ND	--	ND	--	ND	--	ND	--	ND	--
Bromoform	ND	--	ND	--	ND	--	ND	--	ND	--
Isopropylbenzene	160	0.16	290	0.29	52	0.052	3.1	0.0031	2.1	0.0021
1,1,2,2-Tetrachloroethane	ND	--	ND	--	ND	--	ND	--	ND	--
1,2,3-Trichloropropane	ND	--	ND	--	ND	--	ND	--	ND	--
Bromobenzene	ND	--	ND	--	ND	--	ND	--	ND	--
n-Propylbenzene	270	0.27	960	0.96	270	0.27	21	0.021	9.3	0.0093
2-Chlorotoluene	ND	--	ND	--	ND	--	ND	--	ND	--
4-Chlorotoluene	ND	--	ND	--	ND	--	ND	--	ND	--
1,3,5-Trimethylbenzene	620	0.62	2000	2	530	0.53	100	0.1	24	0.024
tert-Butylbenzene	2.5	0.0025	9	0.009	3.2	0.0032	0.7	0.0007	ND	--
1,2,4Trimethylbenzene	2100	2.1	3300	3.3	2100	2.1	440	0.44	81	0.081
sec-Butylbenzene	42	0.042	180	0.18	70	0.07	14	0.014	2.2	0.0022
1,3-Dichlorobenzene	ND	--	ND	--	ND	--	ND	--	ND	--
4-Isopropyltoluene	44	0.044	180	0.18	81	0.081	19	0.019	1.9	0.0019
1,4-Dichlorobenzene	ND	--	ND	--	ND	--	ND	--	ND	--
n-Butylbenzene	ND	--	ND	--	ND	--	41	0.041	ND	--
1,2-Dichlorobenzene	ND	--	ND	--	ND	--	ND	--	ND	--
1,2-Dibromo-3-chloropropane	ND	--	ND	--	ND	--	ND	--	ND	--
1,2,4-Trichlorobenzene	ND	--	ND	--	ND	--	ND	--	ND	--
1,2,3-Trichlorobenzene	ND	--	ND	--	ND	--	ND	--	ND	--
Naphthalene	110	0.11	150	0.15	190	0.19	140	0.14	21	0.021
Hexachlorobutadiene	ND	--	ND	--	ND	--	ND	--	ND	--
Dibromofluoromethane (%)	94	%	94	%	95	%	97	%	98	%
Toluene-d8 (%)	98	%	107	%	108	%	108	%	104	%
4-Bromofluorobenzene (%)	84	%	92	%	98	%	104	%	97	%
VOC Totals	**42684.5**	**42.685**	**55595**	**55.595**	**34512.2**	**34.5122**	**26322.2**	**26.3222**	**10105.1**	**10.1051**

APPENDIX F

VOC TIC'S – LIQUID PHASE

Run 1		Run 2					
8/26/08		9/26/08		10/3/08		10/9/08	
TICs	Result (ug/L)	TICs	Result (ug/L)	TICs	Result (ug/L)	TICs	Result (ug/L)
Unknown Branched Cycloalkane	1.7	Benzene, 1-ethyl-4-methyl-	150000	Benzene, 1-ethyl-3-methyl-	860	Sulfur dioxide	52
Cyclohexane, propyl-	1.9	Benzene, 1-ethyl-2-methyl-	42000	Benzene, 1-ethyl-2-methyl-	350	Unknown	180
Unknown Branched Cycloalkane	1.6	Benzene, 1-methyl-3-propyl	12000	Unknown Substituted Benzene	25	Unknown Substituted Benzene(s)	677
Unknown	2.1	Benzene, 4-3thyl-1,2-dimethyl-	24000	Benzene, 1,2,3-trimethyl-	370	Unknown Aromatic	63
Unknown	1			Benzene, 1-methyl-2-(1-methylethyl)	2.8		
Cyclohexane, butyl-	1			Unknown Aromatic	100		
Unknown	1.3			Unknown Substituted Benzene	41		
				Benzene, 1,2-diethyl-	5.6		
				Benzene, 1-methyl-2-propyl	19		
				Unknown Substituted Benzene	29		
				Benzene, 1-methyl-3-(1-methylethyl	23		
				Unknown Substituted Benzene	58		
				Benzene, 1-ethyl-2,3-dimethyl-	5.7		
				Benzene, 4-ethyl-1,2-dimethyl-	10		
				Benzene, 1,2,3,4-tetramethyl-	16		
				Benzene, 1,2,4,5-tetramethyl-	24		
				Unknown Substituted Benzene	2.4		
				1H-Indene, 2,3-dihydro-4-methyl-	2.4		
				Unknown Substituted Benzene	7.4		
				1H-Indene, 1-methyl-	4.8		
	10.6		228000		1956.1		972

Run 3					
12/10/08		12/20/08		1/8/09	
TICs	Result (ug/L)	TICs	Result (ug/L)	TICs	Result (ug/L)
2-Propenoic acid, 2-methyl-, methy	340	2-Propanol, 2-methyl-	1200	Silane, fluorotrimethyl-	1.7
Benzene, 1-ethyl-3-methyl-	18000	Propanal, 2-methyl-	2.7	2-Propanol, 2-methyl-	600
Benzene, 1-ethyl-2-methyl	6300	Disulfide, dimethyl	2.3	Propanal, 2-methyl-	3.2
Benzene, 1,2,3-trimethyl-	6100	Benzene, 1-ethyl-2-methyl-	44	3-Pentanone, 2,4-dimethyl-	1
Indane	1900	Unknown Substituted Benzene	18	Benzene, 1-ethyl-2-methyl-	440
Benzene,1-methyl-3-propyl-	400	Benzene, 1-methyl-3-propyl-	2.1	Benzene, 1-ethyl-4-methyl-	160
Benzene, 2-ethyl-1,4-dimethyl-	280	Unknown Substituted Benzene	6.8	Unknown Aromatic	60
Unknown Substituted Benzene	480			Benzene, 1-methyl-2-propyl	3.3
				Unknown Substituted Benzene	8.6
				Benzene, 4-ethyl-1,2-dimethyl	12
				Unknown Substituted Benzene	1.5
				Benzene, 1-methyl-2-(1-methylethyl	2
				Benzene, 1,2,3,4-tetramethyl-	4.5
				Benzene, 1,2,4,5-tetramethyl-	1.6
	33800		1275.9		1299.4

Run 4							
2/10/09		2/18/09		2/27/09		2/27/2009 decant	
TICs	Result (ug/L)	TICs	Result (ug/L)	TICs	Result (ug/L)	TICs	Result (ug/L)
2-Propanol, 2-methyl-	2300	4-Heptanone	45	Unknown Aromatic	31	Unknown Substituted Benzene	410
4-Heptanone	71	Unknown	34	Unknown	15	Unknown Substituted Benzene	15
Cyclohexane, propyl-	51	Unknown Substituted Benzene	810	2-Propanol, 2-methyl-	2200	Unknown Substituted Benzene	190
Benzene, 1-ethyl-2-methyl-	6700	Unknown Substituted Benzene	160	Naphthalene, 1,2,3,4-tetrahydro-	26	Unknown Substituted Benzene	64
Benzene, 1-ethyl-3-methyl-	4200	Unknown Substituted Benzene	110	4-Heptanone	350	Unknown Substituted Benzene	130
Benzene, 1-methyl-3-(1-methylethyl	370	Benzene, 4-ethyl-1,2-dimethyl-	490	Benzene, 1-ethyl-2-methyl-	1900	Unknown Substituted Benzene	840
Unknown Substituted Benzene	42	Benzene, 1-methyl-2-propyl-	130	Benzene, 1-ethyl-4-methyl-	2700	Unknown Substituted Benzene	20
Benzene, 1-ethenyl-2-methyl-	2100	Benzene, 2-ethyl-1,4-dimethyl-	250	Benzene, 1-ethenyl-4-methyl-	830	Unknown Aromatic	20
Unknown Alkane	55	Benzene, 1,2,4,5-tetramethyl-	230	Benzene, 1-methyl-4-propyl-	110	Unknown Substituted Benzene	120
Benzene, 1,2-diethyl-	53	Unknown Substituted Benzene	2900	Heptane, 3-ethyl-2-methyl-	28	Unknown Aromatic	36
Benzene, 1-methyl-2-propyl-	240	Benzene, 1,2-diethyl-	30	Unknown Alkane	13	Unknown Substituted Benzene	3000
Benzene, 2-ethyl-1,4-dimethyl-	520	Benzene, 1,2,3,4-tetramethyl-	160	Unknown Substituted Benzene	27	Benzene, 2-ethyl-1,4-dimethyl-	220
Benzene, 1-methyl-2-(1-methylethyl	350	Benzene, 1-ethyl-2-methyl-	1600	Unknown Substituted Benzene	120	Benzene, 1-methyl-2-propyl-	110
Unknown Substituted Benzene	810	Benzene, 1-ethyl-3-methyl-	700	Unknown Aromatic	16	Benzene, 1-ethyl-2-methyl-	1900
Unknown Substituted Benzene	130	1H-Indene, 2,3-dihydro-5-methyl-	36	Unknown Aromatic	10	Unknown Substituted Benzene	130
Benzene, 4-ethyl-1,2-dimethyl-	160	Undecane	54	Unknown Substituted Benzene	210	Benzene, 1,2-diethyl-	23
Benzene, 1,2,3,5-tetramethyl-	240	Benzene, 1-methyl-2-(2-propenyl)-	140	Unknown Substituted Benzene	65	4-Heptanone	330
Benzene, 1,2,4,5-tetramethyl-	330	2-Propanol, 2-methyl-	2100	Unknown Substituted Benzene	89	Naphthalene, 1,2,3,4-tetrahydro-	26
Unknown Aromatic	39	Unknown Substituted Benzene	78	Unknown Substituted Benzene	130	2-Propanol, 2-methyl-	2200
Unknown Substituted Benzene	180	Unknown Substituted Benzene	170	Unknown Substituted Benzene	190	Unknown	22
		Butylated Hydroxytoluene	7.6	Unknown Substituted Benzene	14	Cyclohexane, 1,1,2,3-tetramethyl-	13
		Butylated Hydroxytoluene	36	Undecane	11	Benzene, 1-methyl-2-(1-methylethyl	88
				Unknown Substituted Benzene	130		
	18941		10270.6		9215		9907

Run 5					
3/6/09		3/13/09		3/23/09	
TICs	Result (ug/L)	TICs	Result (ug/L)	TICs	Result (ug/L)
Benzene, 1-ethyl-2-methyl-	7500	Disulfide, dimethyl	17	Benzene, 2-ethyl-1,3-dimethyl-	24
1-Butanol	3500	Benzene, 2-ethyl-1,4-dimethyl-	70	Unknown Aromatic	18
4-Heptanone	83	Nonane, 3-methyl-	18	Unknown Substituted Benzene	19
Butanal	95	2-Propanol, 2-methyl-	3100	Unknown Substituted Benzene	12
Benzene, 1,2,3,5-tetramethyl-	100	Naphthalene, 1,2,3,4-tetrahydro-	23	Decane, 4-methyl-	11
Benzene, 2-ethyl-1,4-dimethyl-	190	Benzene, 1,2,3-trimethyl-	1300	Undecane	33
Unknown Substituted Benzene	3100	Benzene, 1-methyl-3-(1-methylethyl	130	Benzene, 1-ethyl-3-methyl-	350
Unknown Substituted Benzene	180	Benzene, 1-ethyl-3-methyl-	1500	Benzene, 1-ethyl-2-methyl-	130
Unknown Substituted Benzene	71	Benzene, (2-methyl-1-propenyl)-	33	Benzene, 1,2,3,5-tetramethyl-	16
Unknown Substituted Benzene	3700	Heptane, 3-ethyl-2-methyl-	11	Ethanone, 1-(2-methylphenyl)-	11
Unknown Substituted Benzene	250	Nonane, 4-methyl-	13	Unknown Substituted Benzene	41
Unknown Substituted Benzene	99	Unknown Cyclic Alkane	24	Benzene, 1-methyl-3-(1-methylethyl	15
Unknown Substituted Benzene	140	Unknown Branched Alkane	9.8	2-Propanol, 2-methyl-	1300
Unknown Substituted Benzene	360	Unknown Aromatic Hydrocarbon	180	Benzaldehyde	94
Unknown Substituted Benzene	65	Unknown Aromatic Hydrocarbon	340	Indane	78
Unknown Substituted Benzene	140	Unknown Branched Alkane	18	Butanal	19
Unknown Aromatic	940	Unknown Aromatic Hydrocarbon	42	Benzene, 1,2,3,4-tetramethyl-	22
Butylated Hydroxytoluene	280	Unknown Aromatic Hydrocarbon	220	Benzene, 1,2,3-trimethyl-	190
Butylated Hydroxytoluene	16	Unknown Aromatic Hydrocarbon	400	4-Heptanone	11
		Unknown Substituted Benzene	100	Butylated Hydroxytoluene	12
		Unknown Substituted Benzene	12		
		Benzene, 1-ethyl-2-methyl-	720		
		Unknown Aromatic Hydrocarbon	90		
		Unknown Cyclic Alkane	32		
		Unknown Aromatic Hydrocarbon	90		
		Unknown Hydrocarbon	11		
		Unknown Aromatic Hydrocarbon	170		
		Unknown Aromatic Hydrocarbon	120		
		Unknown Aromatic Hydrocarbon	39		
		Unknown Substituted Benzene	2500		
		Butylated Hydroxytoluene	18		
	20809		11350.8		2406

Run 6									
5/5/09		5/6/09		5/7/09		5/8/09		5/22/09	
TICs	Result (ug/L)	TICs	Result (ug/L)	TICs	Result (ug/L)	TICs	Result (ug/L)	TICs	Result (ug/L)
Indane	420	Unknown Cyclic Alkane	710	Pentalene, octahydro-2-methyl-	160	Octane, 2,6-dimethyl-	90	Benzene, 1,2,3-trimethyl-	56
Ethanol	140	Unknown Hydrocarbon	420	Undecane	290	Unknown Substituted Benzene	100	Acetaldehyde	21
Dodecane	29	Unknown Alkane	200	Cyclohexane, 1,2,3-trimethyl-, (1.	70	Unknown Substituted Benzene	67	Benzene, 1-chloro-2-(trifluorometh	11
2-Ethoxyethyl acetate	250	Unknown Substituted Benzene	290	1-Butanol	110	Unknown Alkane	73	Dodecane	55
2-Heptanone	160	Unknown Substituted Benzene	350	Benzene, 1-chloro-4-(trifluorometh	380	Unknown Alkane	36	Benzene, 1-ethyl-2-methyl-	27
2-Pentanone	35	Unknown Substituted Benzene	190	4-Heptanone	190	Unknown Branched Alkane	56	Benzene, 1-ethyl-4-methyl-	65
Benzaldehyde	46	Unknown Substituted Benzene	280	Benzene, 1-methyl-2-(1-methylethyl	77	Unknown Branched Alkane	63	Disulfide, dimethyl	11
Benzene, 1,2,4,5-tetramethyl-	69	Benzene, 1,2,3-trimethyl-	1800	Benzene, 1-ethyl-2-methyl-	220	Unknown Hydrocarbon	50	Undecane	120
Acetic acid, methyl ester	1500	Unknown Branched Alkane	260	Benzene, 1-ethyl-3-methyl-	590	Unknown Branched Hydrocarbon	34	Octane, 2,6-dimethyl-	11
1-Butanol	330	Unknown Substituted Benzene	260	Cyclohexane, (1-methylethyl)-	95	Nonane, 4-methyl-	59	Decane, 4-methyl-	47
Acetic acid, butyl ester	1200	Benzene, 1-methyl-3-propyl-	500	Benzene, 1-methyl-3-propyl-	97	Decane, 3-methyl-	40	Undecane, 4-methyl-	21
Benzene, 1,2,3,5-tetramethyl-	47	Benzene, 4-ethyl-1,2-dimethyl-	390	Cyclohexane, propyl-	720	Nonane, 3-methyl-	87	Undecane, 2-methyl-	10
Benzene, 1-methyl-3-(1-methylethyl	92	Benzene, 1-methyl-2-propyl-	300	Octane, 2,6-dimethyl-	460	Benzene, cyclobutyl-	35	Decane, 3-methyl-	24
Benzene, 1-ethyl-2-methyl-	750	Benzene, 1-chloro-4-(trifluorometh	2200	1-Ethyl-3-methylcyclohexane (c,t)	160	Octane, 3-methyl-	32	Unknown Branched Alkane	11
Benzene, 1-ethyl-3-methyl-	2000	Dodecane	190	Cyclohexane, 1-ethyl-4-methyl-, ci	110	Benzene, 2-ethyl-1,4-dimethyl-	53	Unknown Nitrile	32
Cyclohexane, 1-ethyl-4-methyl-, tr	73	Benzene, 2-propenyl-	670	Unknown Branched Hydrocarbon	84	Benzene, 1,2,3,5-tetramethyl-	52	Unknown Hydrocarbon	11
Unknown Substituted Benzene	76	Benzene, 1,2,3,4-tetramethyl-	200	Unknown Hydrocarbon	140	Benzene, 1-ethyl-3-methyl-	190	Unknown Cyclic Hydrocarbon	28
Unknown Substituted Benzene	75	Heptane, 3-ethyl-2-methyl-	220	Unknown Branched Alkane	130	Benzene, (1-methyl-1-propenyl)-, (	35	Unknown Alkane	41
Naphthalene, 1,2,3,4-tetrahydro-	47	Benzene, 1-ethyl-2-methyl-	1500	Unknown Alkane	220	Benzene, 1,2,4,5-tetramethyl-	67	Unknown Substituted Benzene	13
Nonane, 4-methyl-	48	Benzene, 1-ethyl-3-methyl-	4700	Unknown Branched Cycloalkane	110	Benzaldehyde	41	Unknown Branched Alkane	20
Indan, 1-methyl-	100	Pentane, 2,2,3,3-tetramethyl-	400	Cyclohexane, 1,1,3-trimethyl-	160	Dodecane	38	Unknown Alkane	14
Decane, 4-methyl-	32	Undecane	1100	Unknown Hydrocarbon	210	Benzene, 2-ethyl-1,3-dimethyl-	68	Unknown Substituted Benzene	11
Octane, 3-methyl-	27	Cyclohexane, propyl-	790	Cyclohexane, 1,2,4-trimethyl-, (1	200	Benzene, 1,2,3-trimethyl-	230	Benzaldehyde	34
Benzene, (1-methyl-1-propenyl)-, (	120	Cyclohexane, 1,3,5-trimethyl-	260	Unknown branched Hydrocarbon	230	Cyclohexane, propyl-	110	Unknown Substituted Benzene	13
Undecane	130	Octane, 2,6-dimethyl-	390	Unknown Substituted Benzene	80	Benzene, 1-methyl-2-(1-methylethyl	32	(2-Methylbutyl)cyclohexane	39
Benzene, 1-methyl-2-propyl-	68	Octane, 3-methyl-	240	Unknown Substituted Benzene	82	Benzene, 1-ethyl-2-methyl-	64		
Benzene, 4-ethyl-1,2-dimethyl-	100	Cyclohexane, 1,1,3-trimethyl-	290	Unknown Substituted Benzene	150	Benzene, 4-ethyl-1,2-dimethyl-	75		
Nonane, 2-methyl-	35	Cyclohexane, 1-ethyl-4-methyl-, ci	230	Unknown Alkane	240	Benzene, 1-methyl-2-propyl-	41		
Octane, 2,6-dimethyl-	64	Benzene, 1,2,3,5-tetramethyl-	240	Unknown Cyclic Alkane	92	Undecane	230		
Unknown Branched Cycloalkane	34	Nonane, 3-methyl-	590	Unknown Branched Alkane	260	Butylated Hydroxytoluene	38		
						Butylated Hydroxytoluene	22		
						Butylated Hydroxytoluene	24		
	8097		20160		6117		2232		746

APPENDIX G

SVOC’S – LIQUID PHASE

	Run 1		Run 2					
	8/26/08		9/26/08		10/3/08		10/9/08	
Analyte Name	**Result (ug/L)**	**Results (mg/L)**	**Result (ug/L)**	**Results (mg/L)**	**Result (ug/L)**	**Results (mg/L)**	**Result (ug/L)**	**Results (mg/L)**
N-Nitrosodimethylamine	ND	--	ND	--	ND	--	ND	--
Aniline	ND	--	ND	--	ND	--	ND	--
Bis(2-chloroethyl) Ether	ND	--	ND	--	ND	--	ND	--
Phenol	ND	--	ND	--	18	0.018	ND	--
2-Chlorophenol	ND	--	ND	--	ND	--	ND	--
1,3-Dichlorobenzene	ND	--	ND	--	ND	--	ND	--
1,4-Dichlorobenzene	ND	--	ND	--	ND	--	ND	--
1,2-Dichlorobenzene	ND	--	ND	--	ND	--	ND	--
Benzyl alcohol	ND	--	480	0.48	44	0.044	31	0.031
Bis(2-chloroethyl) Ether	ND	--	ND	--	ND	--	ND	--
2-Methylphenol	ND	--	ND	--	36	0.036	ND	--
Hexachloroethane	ND	--	ND	--	ND	--	ND	--
N-Nitrosodi-n-propylamine	ND	--	ND	--	ND	--	ND	--
4-Methylphenol	ND	--	110	0.11	140	0.14	ND	--
Nitrobenzene	ND	--	ND	--	ND	--	ND	--
Isophorone	ND	--	ND	--	ND	--	ND	--
2-Nitrophenol	ND	--	ND	--	ND	--	ND	--
2,4-Dimethylphenol	ND	--	ND	--	ND	--	ND	--
Bis(2-chloroethoxy)methane	ND	--	ND	--	ND	--	ND	--
2,4-Dichlorophenol	ND	--	ND	--	ND	--	ND	--
Benzoic acid	ND	--	ND	--	ND	--	ND	--
1,2,4-Trichlorobenzene	ND	--	ND	--	ND	--	ND	--
Naphthalene	ND	--	680	0.68	20	0.02	ND	--
4-Chloroaniline	ND	--	ND	--	ND	--	ND	--
Hexachlorobutadiene	ND	--	ND	--	ND	--	ND	--
4-Chloro-3-methylphenol	ND	--	ND	--	ND	--	ND	--
2-Methylnaphthalene	ND	--	16	0.016	ND	--	ND	--
Hexachlorocyclopentadiene	ND	--	ND	--	ND	--	ND	--
2,4,6-Trichlorophenol	ND	--	ND	--	ND	--	ND	--
2,4,5-Trichlorophenol	ND	--	ND	--	ND	--	ND	--
2-Chloronaphthalene	ND	--	ND	--	ND	--	ND	--
2-Nitroaniline	ND	--	ND	--	ND	--	ND	--
Acenaphthylene	ND	--	ND	--	ND	--	ND	--
Dimethyl Phthalate	ND	--	ND	--	ND	--	ND	--
2,6-Dinitrotoluene	ND	--	ND	--	ND	--	ND	--
Acenaphthene	ND	--	ND	--	ND	--	ND	--
3-Nitroaniline	ND	--	ND	--	ND	--	ND	--
2,4-Dinitrophenol	ND	--	ND	--	ND	--	ND	--
Dibenzofuran	ND	--	ND	--	ND	--	ND	--
4-Nitrophenol	ND	--	ND	--	ND	--	ND	--
2,4-Dinitrotoluene	ND	--	ND	--	ND	--	ND	--
Fluorene	ND	--	ND	--	ND	--	ND	--
4-Chlorophenyl Phenyl Ether	ND	--	ND	--	ND	--	ND	--
Diethyl Phthalate	ND	--	ND	--	ND	--	ND	--
4-Nitroaniline	ND	--	ND	--	ND	--	ND	--
2-Methyl-4,6-dinitrophenol	ND	--	ND	--	ND	--	ND	--
N-Nitrosodiphenylamine	ND	--	ND	--	ND	--	ND	--
4-Bromophenyl Phenyl Ether	ND	--	ND	--	ND	--	ND	--
Hexachlorobenzene	ND	--	ND	--	ND	--	ND	--
Pentachlorophenol	ND	--	ND	--	160	0.16	ND	--
Phenanthrene	ND	--	ND	--	ND	--	ND	--
Anthracene	ND	--	ND	--	ND	--	ND	--
Di-n-butyl Phthalate	0.49	0.00049	560	0.56	280	0.28	220	0.22
Fluoranthene	ND	--	ND	--	ND	--	ND	--
Pyrene	ND	--	ND	--	ND	--	ND	--
Butyl Benzyl Phthalate	ND	--	36000	36	45000	45	33000	33
3,3'-Dichlorobenzidine	ND	--	ND	--	ND	--	ND	--
Benz(a)anthracene	ND	--	ND	--	ND	--	ND	--
Chrysene	ND	--	ND	--	ND	--	ND	--
Bis(2-ethylhexyl) Phthalate	120	0.12	120	0.12	ND	--	23	0.023
Di-n-octyl Phthalate	ND	--	ND	--	11	0.011	ND	--
Benzo(b)fluoranthene	ND	--	ND	--	ND	--	ND	--
Benzo(k)fluoranthene	ND	--	ND	--	ND	--	ND	--
Benzo(a)pyrene	ND	--	ND	--	ND	--	ND	--
Indeno(1,2,3-cd)pyrene	ND	--	ND	--	ND	--	ND	--
Dibenz(a,h)anthracene	ND	--	ND	--	ND	--	ND	--
Benzo(g,h,i)perylene	ND	--	ND	--	ND	--	ND	--
Totals	**120.49**	**0.1205**	**37966**	**37.966**	**45709**	**45.709**	**33274**	**33.274**

	Run 3					
	12/10/08		12/20/08		1/8/09	
Analyte Name	**Result (ug/L)**	**Results (mg/L)**	**Result (ug/L)**	**Results (mg/L)**	**Result (ug/L)**	**Results (mg/L)**
N-Nitrosodimethylamine	ND	--	ND	--	ND	--
Aniline	ND	--	ND	--	ND	--
Bis(2-chloroethyl) Ether	ND	--	ND	--	ND	--
Phenol	1500	1.5	ND	--	ND	--
2-Chlorophenol	ND	--	ND	--	ND	--
1,3-Dichlorobenzene	ND	--	ND	--	ND	--
1,4-Dichlorobenzene	ND	--	ND	--	ND	--
1,2-Dichlorobenzene	ND	--	ND	--	ND	--
Benzyl alcohol	ND	--	140	0.14	59	0.059
Bis(2-chloroethyl) Ether	ND	--	ND	--	ND	--
2-Methylphenol	ND	--	5.3	0.0053	ND	--
Hexachloroethane	ND	--	ND	--	ND	--
N-Nitrosodi-n-propylamine	ND	--	ND	--	ND	--
4-Methylphenol	ND	--	7.2	0.0072	ND	--
Nitrobenzene	ND	--	ND	--	ND	--
Isophorone	ND	--	ND	--	ND	--
2-Nitrophenol	ND	--	ND	--	ND	--
2,4-Dimethylphenol	ND	--	1.9	0.0019	ND	--
Bis(2-chloroethoxy)methane	ND	--	ND	--	ND	--
2,4-Dichlorophenol	ND	--	ND	--	ND	--
Benzoic acid	ND	--	ND	--	86	0.086
1,2,4-Trichlorobenzene	ND	--	ND	--	ND	--
Naphthalene	2700	2.7	ND	--	ND	--
4-Chloroaniline	ND	--	ND	--	ND	--
Hexachlorobutadiene	ND	--	ND	--	ND	--
4-Chloro-3-methylphenol	ND	--	ND	--	ND	--
2-Methylnaphthalene	ND	--	ND	--	ND	--
Hexachlorocyclopentadiene	ND	--	ND	--	ND	--
2,4,6-Trichlorophenol	ND	--	ND	--	ND	--
2,4,5-Trichlorophenol	ND	--	ND	--	ND	--
2-Chloronaphthalene	ND	--	ND	--	ND	--
2-Nitroaniline	ND	--	ND	--	ND	--
Acenaphthylene	ND	--	ND	--	ND	--
Dimethyl Phthalate	ND	--	ND	--	ND	--
2.6-Dinitrotoluene	ND	--	ND	--	ND	--
Acenaphthene	ND	--	ND	--	ND	--
3-Nitroaniline	ND	--	ND	--	ND	--
2,4-Dinitrophenol	ND	--	ND	--	ND	--
Dibenzofuran	ND	--	ND	--	ND	--
4-Nitrophenol	ND	--	ND	--	ND	--
2,4-Dinitrotoluene	ND	--	ND	--	ND	--
Fluorene	ND	--	ND	--	ND	--
4-Chlorophenyl Phenyl Ether	ND	--	ND	--	ND	--
Diethyl Phthalate	ND	--	ND	--	ND	--
4-Nitroaniline	ND	--	ND	--	ND	--
2-Methyl-4,6-dinitrophenol	ND	--	ND	--	ND	--
N-Nitrosodiphenylamine	ND	--	ND	--	ND	--
4-Bromophenyl Phenyl Ether	ND	--	ND	--	ND	--
Hexachlorobenzene	ND	--	ND	--	ND	--
Pentachlorophenol	ND	--	ND	--	ND	--
Phenanthrene	ND	--	ND	--	ND	--
Anthracene	ND	--	ND	--	ND	--
Di-n-butyl Phthalate	1200	1.2	68	0.068	99	0.099
Fluoranthene	ND	--	ND	--	ND	--
Pyrene	ND	--	ND	--	ND	--
Butyl Benzyl Phthalate	130000	130	7900	7.9	19000	19
3,3'-Dichlorobenzidine	ND	--	ND	--	ND	--
Benz(a)anthracene	ND	--	ND	--	ND	--
Chrysene	ND	--	ND	--	ND	--
Bis(2-ethylhexyl) Phthalate	ND	--	57	0.057	120	0.12
Di-n-octyl Phthalate	ND	--	ND	--	ND	--
Benzo(b)fluoranthene	ND	--	ND	--	ND	--
Benzo(k)fluoranthene	ND	--	ND	--	ND	--
Benzo(a)pyrene	ND	--	ND	--	ND	--
Indeno(1,2,3-cd)pyrene	ND	--	ND	--	ND	--
Dibenz(a,h)anthracene	ND	--	ND	--	ND	--
Benzo(g,h,i)perylene	ND	--	ND	--	ND	--
Totals	**135400**	**135.4**	**8179.4**	**8.1794**	**19364**	**19.364**

	Run 4					
	2/10/09		2/18/09		2/27/09	
Analyte Name	**Result (ug/L)**	**Results (mg/L)**	**Result (ug/L)**	**Results (mg/L)**	**Result (ug/L)**	**Results (mg/L)**
N-Nitrosodimethylamine	ND	--	ND	--	ND	--
Aniline	ND	--	ND	--	ND	--
Bis(2-chloroethyl) Ether	ND	--	ND	--	ND	--
Phenol	ND	--	1900	1.9	880	0.88
2-Chlorophenol	ND	--	ND	--	ND	--
1,3-Dichlorobenzene	ND	--	ND	--	ND	--
1,4-Dichlorobenzene	ND	--	ND	--	ND	--
1,2-Dichlorobenzene	ND	--	ND	--	ND	--
Benzyl alcohol	ND	--	ND	--	120	0.12
Bis(2-chloroethyl) Ether	ND	--	ND	--	ND	--
2-Methylphenol	ND	--	ND	--	ND	--
Hexachloroethane	ND	--	ND	--	ND	--
N-Nitrosodi-n-propylamine	ND	--	ND	--	ND	--
4-Methylphenol	130	0.13	290	0.29	170	0.17
Nitrobenzene	ND	--	ND	--	ND	--
Isophorone	ND	--	ND	--	ND	--
2-Nitrophenol	ND	--	ND	--	ND	--
2,4-Dimethylphenol	1100	1.1	88	0.088	ND	--
Bis(2-chloroethoxy)methane	ND	--	ND	--	ND	--
2,4-Dichlorophenol	ND	--	ND	--	ND	--
Benzoic acid	3500	3.5	5000	5	5300	5.3
1,2,4-Trichlorobenzene	ND	--	ND	--	ND	--
Naphthalene	66	0.066	380	0.38	130	0.13
4-Chloroaniline	ND	--	ND	--	ND	--
Hexachlorobutadiene	ND	--	ND	--	ND	--
4-Chloro-3-methylphenol	ND	--	ND	--	ND	--
2-Methylnaphthalene	ND	--	55	0.055	ND	--
Hexachlorocyclopentadiene	ND	--	ND	--	ND	--
2,4,6-Trichlorophenol	ND	--	ND	--	ND	--
2,4,5-Trichlorophenol	ND	--	ND	--	ND	--
2-Chloronaphthalene	ND	--	ND	--	ND	--
2-Nitroaniline	ND	--	ND	--	ND	--
Acenaphthylene	ND	--	ND	--	ND	--
Dimethyl Phthalate	ND	--	ND	--	ND	--
2,6-Dinitrotoluene	ND	--	ND	--	ND	--
Acenaphthene	ND	--	ND	--	ND	--
3-Nitroaniline	ND	--	ND	--	ND	--
2,4-Dinitrophenol	ND	--	ND	--	ND	--
Dibenzofuran	ND	--	ND	--	ND	--
4-Nitrophenol	ND	--	ND	--	ND	--
2,4-Dinitrotoluene	ND	--	ND	--	ND	--
Fluorene	ND	--	ND	--	ND	--
4-Chlorophenyl Phenyl Ether	ND	--	ND	--	ND	--
Diethyl Phthalate	ND	--	ND	--	ND	--
4-Nitroaniline	ND	--	ND	--	ND	--
2-Methyl-4,6-dinitrophenol	ND	--	ND	--	ND	--
N-Nitrosodiphenylamine	ND	--	ND	--	ND	--
4-Bromophenyl Phenyl Ether	ND	--	ND	--	ND	--
Hexachlorobenzene	ND	--	ND	--	ND	--
Pentachlorophenol	ND	--	ND	--	ND	--
Phenanthrene	ND	--	ND	--	ND	--
Anthracene	ND	--	ND	--	ND	--
Di-n-butyl Phthalate	18	0.018	220	0.22	ND	--
Fluoranthene	ND	--	ND	--	ND	--
Pyrene	ND	--	ND	--	ND	--
Butyl Benzyl Phthalate	1400	1.4	41000	41	4700	4.7
3,3'-Dichlorobenzidine	ND	--	ND	--	ND	--
Benz(a)anthracene	ND	--	ND	--	ND	--
Chrysene	ND	--	ND	--	ND	--
Bis(2-ethylhexyl) Phthalate	ND	--	260	0.26	ND	--
Di-n-octyl Phthalate	ND	--	ND	--	ND	--
Benzo(b)fluoranthene	ND	--	ND	--	ND	--
Benzo(k)fluoranthene	ND	--	ND	--	ND	--
Benzo(a)pyrene	ND	--	ND	--	ND	--
Indeno(1,2,3-cd)pyrene	ND	--	ND	--	ND	--
Dibenz(a,h)anthracene	ND	--	ND	--	ND	--
Benzo(g,h,i)perylene	ND	--	ND	--	ND	--
Totals	**6214**	**6.214**	**49193**	**49.193**	**11300**	**11.3**

	Run 5					
	3/6/09		3/13/09		3/23/09	
Analyte Name	**Result (ug/L)**	**Results (mg/L)**	**Result (ug/L)**	**Results (mg/L)**	**Result (ug/L)**	**Results (mg/L)**
N-Nitrosodimethylamine	ND	--	ND	--	ND	--
Aniline	ND	--	ND	--	ND	--
Bis(2-chloroethyl) Ether	ND	--	ND	--	ND	--
Phenol	850	0.85	ND	--	22	0.022
2-Chlorophenol	ND	--	ND	--	ND	--
1,3-Dichlorobenzene	ND	--	ND	--	ND	--
1,4-Dichlorobenzene	ND	--	ND	--	ND	--
1,2-Dichlorobenzene	ND	--	ND	--	ND	--
Benzyl alcohol	280000	280	93000	93	8500	8.5
Bis(2-chloroethyl) Ether	ND	--	ND	--	ND	--
2-Methylphenol	ND	--	ND	--	330	0.33
Hexachloroethane	ND	--	ND	--	ND	--
N-Nitrosodi-n-propylamine	ND	--	ND	--	ND	--
4-Methylphenol	120	0.12	ND	--	270	0.27
Nitrobenzene	ND	--	ND	--	ND	--
Isophorone	ND	--	ND	--	ND	--
2-Nitrophenol	ND	--	ND	--	ND	--
2,4-Dimethylphenol	ND	--	ND	--	ND	--
Bis(2-chloroethoxy)methane	ND	--	ND	--	ND	--
2,4-Dichlorophenol	ND	--	ND	--	ND	--
Benzoic acid	9100	9.1	66000	66	5000	5
1,2,4-Trichlorobenzene	ND	--	ND	--	ND	--
Naphthalene	76	0.076	360	0.36	330	0.33
4-Chloroaniline	ND	--	ND	--	ND	--
Hexachlorobutadiene	ND	--	ND	--	ND	--
4-Chloro-3-methylphenol	ND	--	ND	--	ND	--
2-Methylnaphthalene	ND	--	72	0.072	52	0.052
Hexachlorocyclopentadiene	ND	--	ND	--	ND	--
2,4,6-Trichlorophenol	ND	--	ND	--	ND	--
2,4,5-Trichlorophenol	ND	--	ND	--	ND	--
2-Chloronaphthalene	ND	--	ND	--	ND	--
2-Nitroaniline	ND	--	ND	--	ND	--
Acenaphthylene	ND	--	ND	--	ND	--
Dimethyl Phthalate	ND	--	ND	--	ND	--
2,6-Dinitrotoluene	ND	--	ND	--	ND	--
Acenaphthene	ND	--	ND	--	ND	--
3-Nitroaniline	ND	--	ND	--	ND	--
2,4-Dinitrophenol	ND	--	ND	--	ND	--
Dibenzofuran	ND	--	ND	--	ND	--
4-Nitrophenol	ND	--	ND	--	ND	--
2,4-Dinitrotoluene	ND	--	ND	--	ND	--
Fluorene	ND	--	ND	--	ND	--
4-Chlorophenyl Phenyl Ether	ND	--	ND	--	ND	--
Diethyl Phthalate	ND	--	ND	--	ND	--
4-Nitroaniline	ND	--	ND	--	ND	--
2-Methyl-4,6-dinitrophenol	ND	--	ND	--	ND	--
N-Nitrosodiphenylamine	ND	--	ND	--	ND	--
4-Bromophenyl Phenyl Ether	ND	--	ND	--	ND	--
Hexachlorobenzene	ND	--	ND	--	ND	--
Pentachlorophenol	ND	--	ND	--	ND	--
Phenanthrene	ND	--	ND	--	ND	--
Anthracene	ND	--	ND	--	ND	--
Di-n-butyl Phthalate	23	0.023	250	0.25	210	0.21
Fluoranthene	ND	--	ND	--	ND	--
Pyrene	ND	--	ND	--	ND	--
Butyl Benzyl Phthalate	910	0.91	18000	18	42000	42
3,3'-Dichlorobenzidine	ND	--	ND	--	ND	--
Benz(a)anthracene	ND	--	ND	--	ND	--
Chrysene	ND	--	ND	--	ND	--
Bis(2-ethylhexyl) Phthalate	ND	--	240	0.24	400	0.4
Di-n-octyl Phthalate	ND	--	ND	--	97	0.097
Benzo(b)fluoranthene	ND	--	ND	--	ND	--
Benzo(k)fluoranthene	ND	--	ND	--	ND	--
Benzo(a)pyrene	ND	--	ND	--	ND	--
Indeno(1,2,3-cd)pyrene	ND	--	ND	--	ND	--
Dibenz(a,h)anthracene	ND	--	ND	--	ND	--
Benzo(g,h,i)perylene	ND	--	ND	--	ND	--
Totals	**291079**	**291.08**	**177922**	**177.92**	**57211**	**57.211**

	Run 6									
	5/5/09		5/6/09		5/7/09		5/8/09		5/22/09	
Analyte Name	**Result (ug/L)**	**Results (mg/L)**	**Result (ug/L)**	**Results (mg/L)**	**Result (ug/L)**	**Results (mg/L)**	**Result (ug/L)**	**Results (mg/L)**	**Result (ug/L)**	**Results (mg/L)**
N-Nitrosodimethylamine	ND	--	ND	--	ND	--	ND	--	ND	--
Aniline	ND	--	ND	--	ND	--	ND	--	ND	
Bis(2-chloroethyl) Ether	ND	--	ND	--	ND	--	ND	--	ND	
Phenol	2300	2.3	1900	1.9	ND	--	ND	--	3100	3.1
2-Chlorophenol	ND	--	ND	--	ND	--	ND	--	ND	--
1,3-Dichlorobenzene	ND	--	ND	--	ND	--	ND	--	ND	--
1,4-Dichlorobenzene	ND	--	ND	--	ND	--	ND	--	ND	--
1,2-Dichlorobenzene	ND	--	ND	--	ND	--	ND	--	ND	--
Benzyl alcohol	ND	--	ND	--	ND	--	ND	--	50	0.05
Bis(2-chloroethyl) Ether	ND	--	ND	--	ND	--	ND	--	ND	--
2-Methylphenol	ND	--	ND	--	ND	--	ND	--	110	0.11
Hexachloroethane	ND	--	ND	--	ND	--	ND	--	ND	--
N-Nitrosodi-n-propylamine	ND	--	ND	--	ND	--	ND	--	ND	--
4-Methylphenol	ND	--	ND	--	ND	--	ND	--	ND	--
Nitrobenzene	ND	--	ND	--	ND	--	ND	--	ND	--
Isophorone	ND	--	ND	--	ND	--	ND	--	ND	--
2-Nitrophenol	ND	--	ND	--	ND	--	ND	--	ND	--
2,4-Dimethylphenol	ND	--	ND	--	ND	--	ND	--	42	0.042
Bis(2-chloroethoxy)methane	ND	--	ND	--	ND	--	ND	--	ND	--
2,4-Dichlorophenol	ND	--	ND	--	ND	--	ND	--	ND	--
Benzoic acid	ND	--	ND	--	ND	--	ND	--	1800	1.8
1,2,4-Trichlorobenzene	ND	--	ND	--	ND	--	ND	--	ND	--
Naphthalene	2200	2.2	4000	4	1400	1.4	1800	1.8	71	0.071
4-Chloroaniline	ND	--	ND	--	ND	--	ND	--	ND	--
Hexachlorobutadiene	ND	--	ND	--	ND	--	ND	--	ND	--
4-Chloro-3-methylphenol	ND	--	ND	--	ND	--	ND	--	ND	--
2-Methylnaphthalene	660	0.66	1000	1	450	0.45	710	0.71	56	0.056
Hexachlorocyclopentadiene	ND	--	ND	--	ND	--	ND	--	ND	--
2,4,6-Trichlorophenol	ND	--	ND	--	ND	--	ND	--	ND	--
2,4,5-Trichlorophenol	ND	--	ND	--	ND	--	ND	--	ND	--
2-Chloronaphthalene	ND	--	ND	--	ND	--	ND	--	ND	--
2-Nitroaniline	ND	--	ND	--	ND	--	ND	--	ND	--
Acenaphthylene	ND	--	ND	--	ND	--	ND	--	ND	--
Dimethyl Phthalate	20000	20	24000	24	20000	20	21000	21	2700	2.7
2.6-Dinitrotoluene	ND	--	ND	--	ND	--	ND	--	ND	--
Acenaphthene	ND	--	ND	--	ND	--	ND	--	ND	--
3-Nitroaniline	ND	--	ND	--	ND	--	ND	--	ND	--
2,4-Dinitrophenol	ND	--	ND	--	ND	--	ND	--	ND	--
Dibenzofuran	ND	--	ND	--	ND	--	ND	--	ND	--
4-Nitrophenol	ND	--	ND	--	ND	--	ND	--	ND	--
2,4-Dinitrotoluene	ND	--	ND	--	ND	--	ND	--	ND	--
Fluorene	ND	--	ND	--	ND	--	ND	--	ND	--
4-Chlorophenyl Phenyl Ether	ND	--	ND	--	ND	--	ND	--	ND	--
Diethyl Phthalate	1200	1.2	1400	1.4	830	0.83	1200	1.2	390	0.39
4-Nitroaniline	ND	--	ND	--	ND	--	ND	--	ND	--
2-Methyl-4,6-dinitrophenol	ND	--	ND	--	ND	--	ND	--	ND	--
N-Nitrosodiphenylamine	ND	--	ND	--	ND	--	ND	--	ND	--
4-Bromophenyl Phenyl Ether	ND	--	ND	--	ND	--	ND	--	ND	--
Hexachlorobenzene	ND	--	ND	--	ND	--	ND	--	ND	--
Pentachlorophenol	ND	--	ND	--	ND	--	ND	--	ND	--
Phenanthrene	ND	--	ND	--	ND	--	35	0.035	ND	--
Anthracene	ND	--	ND	--	ND	--	ND	--	ND	--
Di-n-butyl Phthalate	200	0.2	ND	--	35	0.035	44	0.044	ND	--
Fluoranthene	ND	--	ND	--	ND	--	ND	--	ND	--
Pyrene	ND	--	ND	--	ND	--	ND	--	ND	--
Butyl Benzyl Phthalate	ND	--	470	0.47	410	0.41	180	0.18	ND	--
3,3'-Dichlorobenzidine	ND	--	ND	--	ND	--	41	0.041	ND	--
Benz(a)anthracene	ND	--	ND	--	ND	--	ND	--	ND	--
Chrysene	ND	--	ND	--	ND	--	ND	--	ND	--
Bis(2-ethylhexyl) Phthalate	ND	--	ND	--	140	0.14	240	0.24	100	0.1
Di-n-octyl Phthalate	ND	--	ND	--	ND	--	ND	--	ND	--
Benzo(b)fluoranthene	ND	--	ND	--	ND	--	ND	--	ND	--
Benzo(k)fluoranthene	ND	--	ND	--	ND	--	ND	--	ND	--
Benzo(a)pyrene	ND	--	ND	--	ND	--	ND	--	ND	--
Indeno(1,2,3-cd)pyrene	ND	--	ND	--	ND	--	ND	--	ND	--
Dibenz(a,h)anthracene	ND	--	ND	--	ND	--	ND	--	ND	--
Benzo(g,h,i)perylene	ND	--	ND	--	ND	--	ND	--	ND	--
Totals	**26560**	**26.56**	**32770**	**32.77**	**23265**	**23.265**	**25250**	**25.25**	**8419**	**8.419**

APPENDIX H

SVOC TIC'S – LIQUID PHASE

	Run 1		Run 2					
	8/26/08		9/26/08		10/3/08		10/9/08	
Analyte Name	**Result (ug/L)**	**Results (mg/L)**	**Result (ug/L)**	**Results (mg/L)**	**Result (ug/L)**	**Results (mg/L)**	**Result (ug/L)**	**Results (mg/L)**
Unknown Substituted Benzene		0		0		0		0
Unknown Substituted Aromatic Hydro		0		0		0		0
Unknown Substituted Aromatic		0		0		0		0
Unknown Organic Acid		0		0		0		0
Unknown Ketone		0		0		0		0
Unknown Carboxylic Acid		0		0		0	79	0.079
Unknown Branched Cycloalkane								
Unknown Branched Alkane		0		0	410	0.41	745	0.745
Unknown Aromatic Carboxylic Acid		0		0		0		0
Unknown Amine		0		0		0		0
Unknown Alkyl Substituted Alkane								
Unknown Alkane		0		0		0	635	0.635
Unknown	683.45	0.68345	2000	2	5600	5.6	2287	2.287
Undecane, 4-dimethyl-	37	0.037		0		0		0
Undecane, 3-dimethyl-	50	0.05		0		0		0
Undecane, 2,6-dimethyl-		0		0		0	76	0.076
Undecane	66	0.066	4300	4.3		0		0
Trimethylbenzene Isomer		0		0		0		0
Trimethyl Benzene Isomer		0		0		0		0
Pyrrolo[1,2-a]pyrazine,1,4-dione		0		0		0		0
Propanoic acid, 3-hydroxy-2,2-dime		0		0		0		0
Phthalic Anhydride	320	0.32		0		0		0
Phenol, 3-ethyl-5-methyl-		0		0		0		0
Phenol, 3-ethyl-		0		0	1300	1.3		0
Phenol, 2-ethyl-6-methyl-		0		0		0		0
Phenol, 2-ethyl-		0		0	180	0.18		0

	Run 1 – Cont'd		Run 2 - Continued					
	8/26/08		9/26/08		10/3/08		10/9/08	
Analyte Name	**Result (ug/L)**	**Results (mg/L)**	**Result (ug/L)**	**Results (mg/L)**	**Result (ug/L)**	**Results (mg/L)**	**Result (ug/L)**	**Results (mg/L)**
Pentadecanoic acid		0		0		0		0
p-Tolylacetic acid		0		0		0		0
Oxirane, 2-methyl-2-phenyl-		0		0		0		0
Oxacycloheptadecan-2-one		0		0		0		0
Octadecanoic acid, butyl ester		0		0		0		0
Octadecanoic acid								
Octadec-9-enoic acid								
Oct adecnoic acid, 2-[(1-oxohexade		0	1100	1.1		0		0
o-Tolylacetic acid		0		0		0		0
Nonane, 3-methyl-5-propyl-								
Nonane, 3-methyl-	41	0.041		0		0		0
N,N-Dimethyltetradecanamine		0		0		0		0
N-Methyl-N-benzyltetradecanamine		0		0		0	160	0.16
n-Hexadecanoic acid		0		0		0		0
n-Hexadecanoic acid								
n-Dodecylmethyl sulfide		0		0		0		0
Methylphenyl Ethanone Isomer		0		0		0		0
Methyl(1-methylethyl)benzene, isomer		0		0		0		0
m-Tolylacetic acid		0		0		0		0
Indane		0		0		0		0
Hydroxy Methylacetophenone Isomer		0		0		0		0
Hexanoic acid, 2-ethyl-, methyl es	58	0.058		0		0		0
Hexadecenoic acid, Z-11-								
Heptadecanoic acid		0		0		0		0
Heneicosane		0		0		0		0
Glyceryl monostearate								

	Run 1 – Cont’d		Run 2 - Continued					
	8/26/08		9/26/08		10/3/08		8/26/08	
Analyte Name	**Result (ug/L)**	**Results (mg/L)**	**Analyte Name**	**Result (ug/L)**	**Results (mg/L)**	**Analyte Name**	**Result (ug/L)**	**Results (mg/L)**
Ethylmethyl Bezene Isomer		0		0		0		0
Ethylmethyl Benzene Isomer		0		0		0		0
Ethyldimethylbenzene, isomer								
Ethyldimethyl Benzene Isomer		0		0		0		0
Ethenyldimethyl Benzene Isomer		0		0		0		0
Ethanone, 1-(4-methylphenyl)-		0		0		0		0
Ethanone, 1-(3-methoxyphenyl)-		0		0		0		0
Ethanone, 1-(2-methylphenyl)-		0		0		0		0
Dodecanoic acid		0	810	0.81		0		0
Docosane		0	1400	1.4		0		0
Dimethylbenzoic acid, isomer								
Dimethyl Benzoic Acid Isomer		0		0		0		0
Dibenzyl phthalate		0		0	370	0.37		0
Decane, 3-methyl-		0		0		0		0
Decane, 2-methyl-		0		0		0		0
Decane		0		0		0		0
Cyclohexane, pentyl-	40	0.04		0		0		0
Cyclohexane, butyl-								
Cyclohexane, 1-methyl-3-propyl-								
Benzyl methacrylate		0		0		0		0
Benzoic acid, 3,5-dimethyl-		0		0		0		0
Benzoic acid, 3,4-dimethyl-		0		0		0		0
Benzoic acid, 3-methyl-		0		0		0		0
Benzoic acid, 2,6-dimethyl-		0		0		0		0
Benzoic acid, 2,5-dimethyl-		0		0		0		0
Benzenemethanol, .alpha.,4-dimethy		0		0	180	0.18		0

	Run 1 – Cont'd		Run 2 - Continued					
	8/26/08		9/26/08		10/3/08		8/26/08	
Analyte Name	**Result (ug/L)**	**Results (mg/L)**	**Analyte Name**	**Result (ug/L)**	**Results (mg/L)**	**Analyte Name**	**Result (ug/L)**	**Results (mg/L)**
Benzenemethanamine, N,N-dimethyl-		0		0		0		0
Benzeneacetic acid, alpha.-methyl		0		0		0		0
Benzene, 4-ethyl-1,2-dimethyl-		0	18000	18		0		0
Benzene, 2-ethyl-1,4-dimethyl-		0		0		0		0
Benzene, 2-ethyl-1,3-dimethyl-		0		0		0	180	0.18
Benzene, 1,3,5-trimethyl-		0		0	450	0.45		0
Benzene, 1,3-diethyl-		0	16000	16		0		0
Benzene, 1,2,4,5-tetramethyl-		0	970	0.97	350	0.35		0
Benzene, 1,2,4-trimethyl-		0	37000	37	700	0.7		0
Benzene, 1,2,3,5-tetramethyl-		0		0		0		0
Benzene, 1,2,3-trimethyl-		0		0	300	0.3		0
Benzene, 1,2,3-trimethyl-								
Benzene, 1,2-diethyl-		0		0	300	0.3		0
Benzene, 1-methyl-4-propyl-		0		0		0		0
Benzene, 1-methyl-4-(1-methylethyl		0		0	270	0.27		0
Benzene, 1-methyl-3-propyl-		0	16000	16		0		0
Benzene, 1-methyl-3-propyl-		0		0		0		0
Benzene, 1-methyl-3-(1-methylethyl		0	3500	3.5		0		0
Benzene, 1-methyl-2-propyl-		0		0	290	0.29		0
Benzene, 1-methyl-2-(1-methylethyl		0	1000	1	230	0.23		0
Benzene, 1-ethyl-3,5-dimethyl-		0		0		0		0
Benzene, 1-ethyl-3-methyl-								
Benzene, 1-ethyl-2.4-dimethyl-		0	19000	19		0		0
Benzene, 1-ethyl-2,3-dimethyl-		0	700	0.7	720	0.72	20	0.02
Benzene, 1-ethyl-2-methyl-		0		0	210	0.21	77	0.077
Benzene, (2-methylpropyl)-		0		0		0		0

	Run 1 – Cont'd		Run 2 - Continued					
	8/26/08		9/26/08		10/3/08		8/26/08	
Analyte Name	**Result (ug/L)**	**Results (mg/L)**	**Analyte Name**	**Result (ug/L)**	**Results (mg/L)**	**Analyte Name**	**Result (ug/L)**	**Results (mg/L)**
Benzene, (1-methylpropyl)-		0	8200	8.2		0		0
Benzene, (1-methylethyl)-		0	26000	26		0		0
Benzaldehyde, oxime		0		0		0		0
Benzaldehyde		0		0		0		0
Acetophenone		0		0		0		0
9,17-Octadecadienal, (Z)-								
9,12-Octadecadienoyl chloride, (Z,								
9,12-Octadecadienoic acid(Z,Z)-		0		0		0		0
9,12-Octadecadienoic acid, methyl								
9,12-Octadecadienoic acid (Z,Z)-								
9-Octadecenoic acid, (E)-		0		0		0		0
9-Hexadecenoic acid		0		0		0		0
4-Acetylbenzoic acid		0		0		0		0
2(3H)-Benzofuranone, 3-methyl-		0		0	200	0.2		0
2,2'-Bipyridine	40	0.04		0		0		0
2-Propenoic acid, 2-methyl-, hexyl		0		0		0		0
2-Propenoic acid, 2-methyl-, butyl		0	6300	6.3		0		0
2-Propenoic acid, 2-methyl-, 2-met		0		0		0		0
2-Naphthalenol, 1-[(4-methyl-2-nit								
2-Aminophenacetic acid		0		0		0		0
2-Amino-3-methylbenzoic acid		0		0		0		0
2-Acetylbenzoic acid								
1H-Inden-1-one, 2,3-dihydro-		0		0		0		0
14-Pentadecenoic acid		0		0		0		0
1,3-Benzodioxole, 5-propyl-								
1,2-Benzenedicarboxylic acid, ethy								

	Run 1 – Cont'd		Run 2 - Continued					
	8/26/08		9/26/08		10/3/08		8/26/08	
Analyte Name	**Result (ug/L)**	**Results (mg/L)**	**Analyte Name**	**Result (ug/L)**	**Results (mg/L)**	**Analyte Name**	**Result (ug/L)**	**Results (mg/L)**
1,2-Benzenedicarboxylic acid		0		0		0		0
1-Dodecanamine,N,N-dimethyl-		0	640	0.64		0	76	0.076
1-(2-Methoxy-1-methylethyl)-2-meth		0		0		0		0
Totals	1335.45	1.33545	162920	162.92	12060	12.06	4335	4.335

	Run 3					
	12/10/08		12/20/08		1/8/09	
Analyte Name	**Result (ug/L)**	**Results (mg/L)**	**Result (ug/L)**	**Results (mg/L)**	**Result (ug/L)**	**Results (mg/L)**
Unknown Substituted Benzene		0		0	610	0.61
Unknown Substituted Aromatic Hydro		0		0		0
Unknown Substituted Aromatic		0		0		0
Unknown Organic Acid		0		0		0
Unknown Ketone		0		0		0
Unknown Carboxylic Acid		0		0		0
Unknown Branched Cycloalkane		0		0		0
Unknown Branched Alkane		0		0		0
Unknown Aromatic Carboxylic Acid		0		0		0
Unknown Amine		0		0	5610	5.61
Unknown Alkyl Substituted Alkane		0		0		0
Unknown Alkane		0		0	970	0.97
Unknown	4500	4.5	2027	2.027	22934	22.934
Undecane, 4-dimethyl-		0		0		0
Undecane, 3-dimethyl-		0		0		0
Undecane, 2,6-dimethyl-		0		0		0
Undecane		0		0		0
Trimethylbenzene Isomer		0		0		0
Trimethyl Benzene Isomer		0		0		0
Pyrrolo[1,2-a]pyrazine,1,4-dione		0		0		0
Propanoic acid, 3-hydroxy-2,2-dime		0		0	110	0.11
Phthalic Anhydride		0		0		0
Phenol, 3-ethyl-5-methyl-		0		0		0
Phenol, 3-ethyl-		0		0		0
Phenol, 2-ethyl-6-methyl-		0		0		0
Phenol, 2-ethyl-		0		0		0
Pentadecanoic acid		0	230	0.23		0

	Run 3 - Continued					
	12/10/08		12/20/08		1/8/09	
Analyte Name	**Result (ug/L)**	**Results (mg/L)**	**Result (ug/L)**	**Results (mg/L)**	**Result (ug/L)**	**Results (mg/L)**
p-Tolylacetic acid		0		0		0
Oxirane, 2-methyl-2-phenyl-		0		0		0
Oxacycloheptadecan-2-one		0	96	0.096		0
Octadecanoic acid, butyl ester		0		0		0
Octadecanoic acid						
Octadec-9-enoic acid		0		0		0
Oct adecnoic acid, 2-[(1-oxohexade		0		0		0
o-Tolylacetic acid		0		0		0
Nonane, 3-methyl-5-propyl-		0		0		0
Nonane, 3-methyl-		0		0		0
N,N-Dimethyltetradecanamine		0		0	780	0.78
N-Methyl-N-benzyltetradecanamine		0	170	0.17	4130	4.13
n-Hexadecanoic acid		0		0		0
n-Hexadecanoic acid						
n-Dodecylmethyl sulfide		0		0	370	0.37
Methylphenyl Ethanone Isomer		0		0		0
Methyl(1-methylethyl)benzene, isomer		0		0		0
m-Tolylacetic acid		0		0		0
Indane	44000	44		0		0
Hydroxy Methylacetophenone Isomer		0		0		0
Hexanoic acid, 2-ethyl-, methyl es		0		0		0
Hexadecenoic acid, Z-11-						
Heptadecanoic acid		0	97	0.097		0
Heneicosane		0		0	150	0.15
Glyceryl monostearate						
Ethylmethyl Bezene Isomer		0		0		0
Ethylmethyl Benzene Isomer		0		0		0

	Run 3 - Continued					
	12/10/08		12/20/08		1/8/09	
Analyte Name	**Result (ug/L)**	**Results (mg/L)**	**Result (ug/L)**	**Results (mg/L)**	**Result (ug/L)**	**Results (mg/L)**
Ethyldimethylbenzene, isomer						
Ethyldimethyl Benzene Isomer		0		0		0
Ethenyldimethyl Benzene Isomer		0		0		0
Ethanone, 1-(4-methylphenyl)-		0		0		0
Ethanone, 1-(3-methoxyphenyl)-		0		0		0
Ethanone, 1-(2-methylphenyl)-		0		0		0
Dodecanoic acid		0		0		0
Docosane		0	120	0.12		0
Dimethylbenzoic acid, isomer						
Dimethyl Benzoic Acid Isomer		0		0		0
Dibenzyl phthalate		0		0		0
Decane, 3-methyl-		0		0		0
Decane, 2-methyl-		0		0		0
Decane	3300	3.3		0		0
Cyclohexane, pentyl-		0		0		0
Cyclohexane, butyl-		0		0		0
Cyclohexane, 1-methyl-3-propyl-		0		0		0
Benzyl methacrylate		0		0	210	0.21
Benzoic acid, 3,5-dimethyl-		0		0		0
Benzoic acid, 3,4-dimethyl-		0		0		0
Benzoic acid, 3-methyl-		0		0		0
Benzoic acid, 2,6-dimethyl-		0	82	0.082		0
Benzoic acid, 2,5-dimethyl-		0		0		0
Benzenemethanol, .alpha.,4-dimethy		0		0		0
Benzenemethanamine, N,N-dimethyl-		0		0	78	0.078
Benzeneacetic acid, alpha.-methyl		0		0		0
Benzene, 4-ethyl-1,2-dimethyl-	4000	4		0		0

	Run 3 - Continued					
	12/10/08		12/20/08		1/8/09	
Analyte Name	**Result (ug/L)**	**Results (mg/L)**	**Result (ug/L)**	**Results (mg/L)**	**Result (ug/L)**	**Results (mg/L)**
Benzene, 2-ethyl-1,4-dimethyl-		0		0		0
Benzene, 2-ethyl-1,3-dimethyl-		0		0		0
Benzene, 1,3,5-trimethyl-		0	180	0.18		0
Benzene, 1,3-diethyl-	27000	27		0		0
Benzene, 1,2,4,5-tetramethyl-	8000	8		0		0
Benzene, 1,2,4-trimethyl-	340000	340		0		0
Benzene, 1,2,3,5-tetramethyl-	10000	10		0		0
Benzene, 1,2,3-trimethyl-	160000	160		0		0
Benzene, 1,2,3-trimethyl-						
Benzene, 1,2-diethyl-		0		0		0
Benzene, 1-methyl-4-propyl-		0		0		0
Benzene, 1-methyl-4-(1-methylethyl		0		0		0
Benzene, 1-methyl-3-propyl-		0		0		0
Benzene, 1-methyl-3-propyl-		0		0		0
Benzene, 1-methyl-3-(1-methylethyl	6900	6.9		0		0
Benzene, 1-methyl-2-propyl-	17000	17		0		0
Benzene, 1-methyl-2-(1-methylethyl	32000	32		0		0
Benzene, 1-ethyl-3,5-dimethyl-	4500	4.5		0		0
Benzene, 1-ethyl-3-methyl-		0		0		0
Benzene, 1-ethyl-2.4-dimethyl-		0		0		0
Benzene, 1-ethyl-2,3-dimethyl-		0		0		0
Benzene, 1-ethyl-2-methyl-		0		0		0
Benzene, (2-methylpropyl)-	8700	8.7		0		0
Benzene, (1-methylpropyl)-	47000	47		0		0
Benzene, (1-methylethyl)-		0		0		0
Benzaldehyde, oxime		0		0		0
Benzaldehyde		0		0		0

	Run 3 - Continued					
	12/10/08		12/20/08		1/8/09	
Analyte Name	**Result (ug/L)**	**Results (mg/L)**	**Result (ug/L)**	**Results (mg/L)**	**Result (ug/L)**	**Results (mg/L)**
Acetophenone		0		0		0
9,17-Octadecadienal, (Z)-						
9,12-Octadecadienoyl chloride, (Z,		0		0		0
9,12-Octadecadienoic acid(Z,Z)-		0		0		0
9,12-Octadecadienoic acid, methyl		0		0		0
9,12-Octadecadienoic acid (Z,Z)-		0		0		0
9-Octadecenoic acid, (E)-		0	270	0.27		0
9-Hexadecenoic acid		0	140	0.14		0
4-Acetylbenzoic acid		0	210	0.21		0
2(3H)-Benzofuranone, 3-methyl-		0		0		0
2,2'-Bipyridine		0		0		0
2-Propenoic acid, 2-methyl-, hexyl		0		0	32000	32
2-Propenoic acid, 2-methyl-, butyl		0		0	4800	4.8
2-Propenoic acid, 2-methyl-, 2-met		0		0		0
2-Naphthalenol, 1-[(4-methyl-2-nit						
2-Aminophenacetic acid		0	150	0.15		0
2-Amino-3-methylbenzoic acid		0	240	0.24		0
2-Acetylbenzoic acid						
1H-Inden-1-one, 2,3-dihydro-		0		0		0
14-Pentadecenoic acid		0	230	0.23		0
1,3-Benzodioxole, 5-propyl-						
1,2-Benzenedicarboxylic acid, ethy		0		0		0
1,2-Benzenedicarboxylic acid		0		0	600	0.6
1-Dodecanamine,N,N-dimethyl-		0		0		0
1-(2-Methoxy-1-methylethyl)-2-meth		0		0		0
Totals	716900	716.9	4242	4.242	73352	73.352

	Run 4					
	2/10/09		2/18/09		2/27/09	
Analyte Name	**Result (ug/L)**	**Results (mg/L)**	**Result (ug/L)**	**Results (mg/L)**	**Result (ug/L)**	**Results (mg/L)**
Unknown Substituted Benzene		0		0		0
Unknown Substituted Aromatic Hydro		0		0		0
Unknown Substituted Aromatic	5430	5.43		0		0
Unknown Organic Acid		0	2.1	0.0021		0
Unknown Ketone		0	2600	2.6		0
Unknown Carboxylic Acid		0		0	650	0.65
Unknown Branched Cycloalkane		0		0		0
Unknown Branched Alkane		0		0		0
Unknown Aromatic Carboxylic Acid		0		0		0
Unknown Amine		0		0		0
Unknown Alkyl Substituted Alkane		0		0		0
Unknown Alkane		0		0		0
Unknown	10710	10.71	12.05	0.01205	2300	2.3
Undecane, 4-dimethyl-		0		0		0
Undecane, 3-dimethyl-		0		0		0
Undecane, 2,6-dimethyl-		0		0		0
Undecane		0		0		0
Trimethylbenzene Isomer		0	3600	3.6		0
Trimethyl Benzene Isomer		0	7700	7.7		0
Pyrrolo[1,2-a]pyrazine,1,4-dione	210	0.21		0		0
Propanoic acid, 3-hydroxy-2,2-dime		0		0		0
Phthalic Anhydride		0	1500	1.5		0
Phenol, 3-ethyl-5-methyl-	5	0.005		0		0
Phenol, 3-ethyl-		0		0	340	0.34
Phenol, 2-ethyl-6-methyl-	290	0.29		0		0
Phenol, 2-ethyl-		0		0		0
Pentadecanoic acid		0		0		0
p-Tolylacetic acid		0	11000	11		0
Oxirane, 2-methyl-2-phenyl-		0		0		0
Oxacycloheptadecan-2-one		0		0		0

	Run 4 - Continued					
	2/10/09		2/18/09		2/27/09	
Analyte Name	**Result (ug/L)**	**Results (mg/L)**	**Result (ug/L)**	**Results (mg/L)**	**Result (ug/L)**	**Results (mg/L)**
Octadecanoic acid, butyl ester		0	1.6	0.0016		0
Octadecanoic acid						
Octadec-9-enoic acid		0		0		0
Oct adecnoic acid, 2-[(1-oxohexade		0		0		0
o-Tolylacetic acid		0		0	600	0.6
Nonane, 3-methyl-5-propyl-		0		0		0
Nonane, 3-methyl-		0		0		0
N,N-Dimethyltetradecanamine		0		0	880	0.88
N-Methyl-N-benzyltetradecanamine		0		0		0
n-Hexadecanoic acid		0		0		0
n-Hexadecanoic acid						
n-Dodecylmethyl sulfide		0		0		0
Methylphenyl Ethanone Isomer		0	1800	1.8		0
Methyl(1-methylethyl)benzene, isomer		0		0		0
m-Tolylacetic acid		0		0		0
Indane	700	0.7	1500	1.5		0
Hydroxy Methylacetophenone Isomer		0	7700	7.7		0
Hexanoic acid, 2-ethyl-, methyl es		0		0		0
Hexadecenoic acid, Z-11-						
Heptadecanoic acid		0		0		0
Heneicosane		0		0		0
Glyceryl monostearate						
Ethylmethyl Bezene Isomer		0	2100	2.1		0
Ethylmethyl Benzene Isomer		0	5800	5.8		0
Ethyldimethylbenzene, isomer						
Ethyldimethyl Benzene Isomer		0	3500	3.5		0
Ethenyldimethyl Benzene Isomer		0	2300	2.3		0
Ethanone, 1-(4-methylphenyl)-		0		0		0
Ethanone, 1-(3-methoxyphenyl)-		0		0		0
Ethanone, 1-(2-methylphenyl)-		0		0	610	0.61

	Run 4 - Continued					
	2/10/09		2/18/09		2/27/09	
Analyte Name	**Result (ug/L)**	**Results (mg/L)**	**Result (ug/L)**	**Results (mg/L)**	**Result (ug/L)**	**Results (mg/L)**
Dodecanoic acid		0		0		0
Docosane		0		0		0
Dimethylbenzoic acid, isomer						
Dimethyl Benzoic Acid Isomer		0	58700	58.7		0
Dibenzyl phthalate		0		0		0
Decane, 3-methyl-		0		0		0
Decane, 2-methyl-		0		0		0
Decane		0	1400	1.4		0
Cyclohexane, pentyl-		0		0		0
Cyclohexane, butyl-		0		0		0
Cyclohexane, 1-methyl-3-propyl-		0		0		0
Benzyl methacrylate		0		0		0
Benzoic acid, 3,5-dimethyl-	1500	1.5		0	760	0.76
Benzoic acid, 3,4-dimethyl-		0		0		0
Benzoic acid, 3-methyl-	330	0.33		0	290	0.29
Benzoic acid, 2,6-dimethyl-		0		0		0
Benzoic acid, 2,5-dimethyl-		0		0		0
Benzenemethanol, .alpha.,4-dimethy		0		0		0
Benzenemethanamine, N,N-dimethyl-		0		0		0
Benzeneacetic acid, alpha.-methyl		0		0		0
Benzene, 4-ethyl-1,2-dimethyl-		0		0		0
Benzene, 2-ethyl-1,4-dimethyl-	860	0.86		0		0
Benzene, 2-ethyl-1,3-dimethyl-		0		0		0
Benzene, 1,3,5-trimethyl-		0		0	2900	2.9
Benzene, 1,3-diethyl-	320	0.32		0		0
Benzene, 1,2,4,5-tetramethyl-		0		0		0
Benzene, 1,2,4-trimethyl-		0		0		0
Benzene, 1,2,3,5-tetramethyl-		0		0		0
Benzene, 1,2,3-trimethyl-		0		0	3200	3.2
Benzene, 1,2,3-trimethyl-						

	Run 4 - Continued					
	2/10/09		2/18/09		2/27/09	
Analyte Name	**Result (ug/L)**	**Results (mg/L)**	**Result (ug/L)**	**Results (mg/L)**	**Result (ug/L)**	**Results (mg/L)**
Benzene, 1,2-diethyl-		0		0	400	0.4
Benzene, 1-methyl-4-propyl-		0		0		0
Benzene, 1-methyl-4-(1-methylethyl		0		0	330	0.33
Benzene, 1-methyl-3-propyl-		0	1800	1.8	660	0.66
Benzene, 1-methyl-3-propyl-		0		0		0
Benzene, 1-methyl-3-(1-methylethyl		0		0		0
Benzene, 1-methyl-2-propyl-		0		0		0
Benzene, 1-methyl-2-(1-methylethyl		0		0		0
Benzene, 1-ethyl-3,5-dimethyl-		0		0	1100	1.1
Benzene, 1-ethyl-3-methyl-		0		0		0
Benzene, 1-ethyl-2.4-dimethyl-		0		0		0
Benzene, 1-ethyl-2,3-dimethyl-		0		0		0
Benzene, 1-ethyl-2-methyl-		0		0		0
Benzene, (2-methylpropyl)-		0		0		0
Benzene, (1-methylpropyl)-	270	0.27		0	460	0.46
Benzene, (1-methylethyl)-		0		0		0
Benzaldehyde, oxime		0		0		0
Benzaldehyde		0		0		0
Acetophenone		0		0		0
9,17-Octadecadienal, (Z)-						
9,12-Octadecadienoyl chloride, (Z,		0		0		0
9,12-Octadecadienoic acid(Z,Z)-		0		0		0
9,12-Octadecadienoic acid, methyl		0		0		0
9,12-Octadecadienoic acid (Z,Z)-		0		0		0
9-Octadecenoic acid, (E)-		0		0	560	0.56
9-Hexadecenoic acid		0		0		0
4-Acetylbenzoic acid		0		0		0
2(3H)-Benzofuranone, 3-methyl-		0		0		0
2,2'-Bipyridine		0		0		0
2-Propenoic acid, 2-methyl-, hexyl		0		0		0

	Run 4 - Continued					
	2/10/09		2/18/09		2/27/09	
Analyte Name	**Result (ug/L)**	**Results (mg/L)**	**Result (ug/L)**	**Results (mg/L)**	**Result (ug/L)**	**Results (mg/L)**
2-Propenoic acid, 2-methyl-, butyl		0		0		0
2-Propenoic acid, 2-methyl-, 2-met		0		0		0
2-Naphthalenol, 1-[(4-methyl-2-nit						
2-Aminophenacetic acid		0		0		0
2-Amino-3-methylbenzoic acid		0		0		0
2-Acetylbenzoic acid						
1H-Inden-1-one, 2,3-dihydro-	320	0.32	3700	3.7	980	0.98
14-Pentadecenoic acid		0		0		0
1,3-Benzodioxole, 5-propyl-				0		0
1,2-Benzenedicarboxylic acid, ethy		0		0		0
1,2-Benzenedicarboxylic acid		0		0		0
1-Dodecanamine,N,N-dimethyl-		0		0		0
1-(2-Methoxy-1-methylethyl)-2-meth		0		0		0
Totals	20945	20.945	116715.75	116.71575	17020	17.02

	Run 5					
	3/6/09		3/13/09		3/23/09	
Analyte Name	**Result (ug/L)**	**Results (mg/L)**	**Result (ug/L)**	**Results (mg/L)**	**Result (ug/L)**	**Results (mg/L)**
Unknown Substituted Benzene		0	0	0	2100	2.1
Unknown Substituted Aromatic Hydro		0	380	0.38		0
Unknown Substituted Aromatic		0		0		0
Unknown Organic Acid		0		0		0
Unknown Ketone		0		0		0
Unknown Carboxylic Acid		0		0	3000	3
Unknown Branched Cycloalkane		0		0		0
Unknown Branched Alkane		0		0		0
Unknown Aromatic Carboxylic Acid	4200	4.2		0		0
Unknown Amine		0		0		0
Unknown Alkyl Substituted Alkane		0		0		0
Unknown Alkane		0		0		0
Unknown	2710	2.71	2479.25	2.47925	6100	6.1
Undecane, 4-dimethyl-		0		0		0
Undecane, 3-dimethyl-		0		0		0
Undecane, 2,6-dimethyl-		0		0		0
Undecane		0		0		0
Trimethylbenzene Isomer		0	5100	5.1		0
Trimethyl Benzene Isomer		0		0		0
Pyrrolo[1,2-a]pyrazine,1,4-dione	810	0.81		0		0
Propanoic acid, 3-hydroxy-2,2-dime		0		0		0
Phthalic Anhydride		0		0	1100	1.1
Phenol, 3-ethyl-5-methyl-		0		0		0
Phenol, 3-ethyl-		0		0		0
Phenol, 2-ethyl-6-methyl-		0		0		0
Phenol, 2-ethyl-		0		0		0
Pentadecanoic acid		0		0		0
p-Tolylacetic acid		0		0	1600	1.6
Oxirane, 2-methyl-2-phenyl-		0		0	760	0.76
Oxacycloheptadecan-2-one		0		0		0

	Run 5 - Continued					
	3/6/09		3/13/09		3/23/09	
Analyte Name	**Result (ug/L)**	**Results (mg/L)**	**Result (ug/L)**	**Results (mg/L)**	**Result (ug/L)**	**Results (mg/L)**
Octadecanoic acid, butyl ester		0		0		0
Octadecanoic acid						
Octadec-9-enoic acid		0		0		0
Oct adecnoic acid, 2-[(1-oxohexade		0		0		0
o-Tolylacetic acid		0		0		0
Nonane, 3-methyl-5-propyl-		0		0		0
Nonane, 3-methyl-		0		0		0
N,N-Dimethyltetradecanamine		0		0		0
N-Methyl-N-benzyltetradecanamine		0	830	0.83	800	0.8
n-Hexadecanoic acid		0		0	750	0.75
n-Hexadecanoic acid						
n-Dodecylmethyl sulfide		0		0		0
Methylphenyl Ethanone Isomer		0		0		0
Methyl(1-methylethyl)benzene, isomer		0	510	0.51		0
m-Tolylacetic acid		0	2700	2.7		0
Indane		0		0		0
Hydroxy Methylacetophenone Isomer		0		0		0
Hexanoic acid, 2-ethyl-, methyl es		0		0		0
Hexadecenoic acid, Z-11-						
Heptadecanoic acid		0		0		0
Heneicosane		0		0		0
Glyceryl monostearate		0		0		0
Ethylmethyl Bezene Isomer		0		0		0
Ethylmethyl Benzene Isomer		0		0		0
Ethyldimethylbenzene, isomer		0	2350	2.35		0
Ethyldimethyl Benzene Isomer		0		0		0
Ethenyldimethyl Benzene Isomer		0		0		0
Ethanone, 1-(4-methylphenyl)-	400	0.4		0		0
Ethanone, 1-(3-methoxyphenyl)-		0	660	0.66		0
Ethanone, 1-(2-methylphenyl)-		0		0		0

	Run 5 - Continued					
	3/6/09		3/13/09		3/23/09	
Analyte Name	**Result (ug/L)**	**Results (mg/L)**	**Result (ug/L)**	**Results (mg/L)**	**Result (ug/L)**	**Results (mg/L)**
Dodecanoic acid		0		0		0
Docosane		0	590	0.59		0
Dimethylbenzoic acid, isomer		0	3880	3.88		0
Dimethyl Benzoic Acid Isomer		0		0		0
Dibenzyl phthalate		0		0		0
Decane, 3-methyl-		0	450	0.45		0
Decane, 2-methyl-		0	400	0.4		0
Decane		0	990	0.99		0
Cyclohexane, pentyl-		0		0		0
Cyclohexane, butyl-		0		0		0
Cyclohexane, 1-methyl-3-propyl-		0		0		0
Benzyl methacrylate		0		0		0
Benzoic acid, 3,5-dimethyl-		0		0	3800	3.8
Benzoic acid, 3,4-dimethyl-	460	0.46		0		0
Benzoic acid, 3-methyl-	570	0.57		0		0
Benzoic acid, 2,6-dimethyl-		0		0		0
Benzoic acid, 2,5-dimethyl-		0		0	1100	1.1
Benzenemethanol, .alpha.,4-dimethy		0		0		0
Benzenemethanamine, N,N-dimethyl-		0		0		0
Benzeneacetic acid, alpha.-methyl	2600	2.6		0		0
Benzene, 4-ethyl-1,2-dimethyl-		0		0		0
Benzene, 2-ethyl-1,4-dimethyl-		0		0		0
Benzene, 2-ethyl-1,3-dimethyl-		0		0		0
Benzene, 1,3,5-trimethyl-		0		0		0
Benzene, 1,3-diethyl-		0		0		0
Benzene, 1,2,4,5-tetramethyl-		0		0		0
Benzene, 1,2,4-trimethyl-	2700	2.7		0		0
Benzene, 1,2,3,5-tetramethyl-		0		0		0
Benzene, 1,2,3-trimethyl-	5000	5		0	570	0.57
Benzene, 1,2,3-trimethyl-		0		0		0

	Run 5 - Continued					
	3/6/09		3/13/09		3/23/09	
Analyte Name	**Result (ug/L)**	**Results (mg/L)**	**Result (ug/L)**	**Results (mg/L)**	**Result (ug/L)**	**Results (mg/L)**
Benzene, 1,2-diethyl-		0		0		0
Benzene, 1-methyl-4-propyl-		0		0		0
Benzene, 1-methyl-4-(1-methylethyl		0		0		0
Benzene, 1-methyl-3-propyl-		0		0		0
Benzene, 1-methyl-3-propyl-		0	800	0.8		0
Benzene, 1-methyl-3-(1-methylethyl		0		0		0
Benzene, 1-methyl-2-propyl-		0		0		0
Benzene, 1-methyl-2-(1-methylethyl		0		0		0
Benzene, 1-ethyl-3,5-dimethyl-		0		0		0
Benzene, 1-ethyl-3-methyl-		0		0		0
Benzene, 1-ethyl-2.4-dimethyl-		0		0		0
Benzene, 1-ethyl-2,3-dimethyl-		0		0		0
Benzene, 1-ethyl-2-methyl-		0		0		0
Benzene, (2-methylpropyl)-		0		0		0
Benzene, (1-methylpropyl)-		0		0		0
Benzene, (1-methylethyl)-		0		0		0
Benzaldehyde, oxime		0		0	750	0.75
Benzaldehyde		0		0	940	0.94
Acetophenone	370	0.37		0		0
9,17-Octadecadienal, (Z)-		0		0		0
9,12-Octadecadienoyl chloride, (Z,		0		0		0
9,12-Octadecadienoic acid(Z,Z)-		0		0		0
9,12-Octadecadienoic acid, methyl		0		0		0
9,12-Octadecadienoic acid (Z,Z)-	450	0.45		0		0
9-Octadecenoic acid, (E)-	1100	1.1		0	1100	1.1
9-Hexadecenoic acid		0		0		0
4-Acetylbenzoic acid		0		0		0
2(3H)-Benzofuranone, 3-methyl-		0		0		0
2,2'-Bipyridine		0		0		0
2-Propenoic acid, 2-methyl-, hexyl		0		0		0

	Run 5 - Continued					
	3/6/09		3/13/09		3/23/09	
Analyte Name	**Result (ug/L)**	**Results (mg/L)**	**Result (ug/L)**	**Results (mg/L)**	**Result (ug/L)**	**Results (mg/L)**
2-Propenoic acid, 2-methyl-, butyl		0		0	740	0.74
2-Propenoic acid, 2-methyl-, 2-met		0		0	4800	4.8
2-Naphthalenol, 1-[(4-methyl-2-nit		0		0		0
2-Aminophenacetic acid		0		0		0
2-Amino-3-methylbenzoic acid		0		0		0
2-Acetylbenzoic acid		0		0		0
1H-Inden-1-one, 2,3-dihydro-	1500	1.5	740	0.74	670	0.67
14-Pentadecenoic acid		0		0		0
1,3-Benzodioxole, 5-propyl-	1100	1.1		0		0
1,2-Benzenedicarboxylic acid, ethy		0		0		0
1,2-Benzenedicarboxylic acid		0		0		0
1-Dodecanamine,N,N-dimethyl-		0		0		0
1-(2-Methoxy-1-methylethyl)-2-meth		0		0	1900	1.9
Totals	23970	23.97	22859.25	22.85925	32580	32.58

	Run 6					
	5/5/09		5/6/09		5/7/09	
Analyte Name	**Result (ug/L)**	**Results (mg/L)**	**Result (ug/L)**	**Results (mg/L)**	**Result (ug/L)**	**Results (mg/L)**
Unknown Substituted Benzene		--	20000	20	5400	5.4
Unknown Substituted Aromatic Hydro		--		--		--
Unknown Substituted Aromatic	11000	11		--		--
Unknown Organic Acid		--		--		--
Unknown Ketone		--		--		--
Unknown Carboxylic Acid		--		--	19900	19.9
Unknown Branched Cycloalkane		--	21000	21	6200	6.2
Unknown Branched Alkane		--		--		--
Unknown Aromatic Carboxylic Acid		--		--		--
Unknown Amine		--		--		--
Unknown Alkyl Substituted Alkane	21000	21		--		--
Unknown Alkane		--		--		--
Unknown	130000	130	45000	45	12700	12.7
Undecane, 4-dimethyl-		--		--		--
Undecane, 3-dimethyl-		--		--		--
Undecane, 2,6-dimethyl-		--		--		--
Undecane	43000	43	50000	50	9200	9.2
Trimethylbenzene Isomer		--		--		--
Trimethyl Benzene Isomer		--		--		--
Pyrrolo[1,2-a]pyrazine,1,4-dione		--		--		--
Propanoic acid, 3-hydroxy-2,2-dime		--		--		--
Phthalic Anhydride	32000	32	42000	42	8400	8.4
Phenol, 3-ethyl-5-methyl-		--		--		--
Phenol, 3-ethyl-		--		--		--
Phenol, 2-ethyl-6-methyl-		--		--		--
Phenol, 2-ethyl-		--		--		--
Pentadecanoic acid		--		--		--
p-Tolylacetic acid	11000	11		--	5500	5.5
Oxirane, 2-methyl-2-phenyl-		--		--		--
Oxacycloheptadecan-2-one		--		--		--

	Run 6 - Continued					
	5/5/09		5/6/09		5/7/09	
Analyte Name	**Result (ug/L)**	**Results (mg/L)**	**Result (ug/L)**	**Results (mg/L)**	**Result (ug/L)**	**Results (mg/L)**
Octadecanoic acid, butyl ester		--		--		--
Octadecanoic acid						
Octadec-9-enoic acid		--	55000	55		--
Oct adecnoic acid, 2-[(1-oxohexade		--		--		--
o-Tolylacetic acid		--		--		--
Nonane, 3-methyl-5-propyl-		--	21000	21		--
Nonane, 3-methyl-		--		--		--
N,N-Dimethyltetradecanamine		--		--		--
N-Methyl-N-benzyltetradecanamine		--		--		--
n-Hexadecanoic acid		--		--		--
n-Hexadecanoic acid						
n-Dodecylmethyl sulfide		--		--		--
Methylphenyl Ethanone Isomer		--		--		--
Methyl(1-methylethyl)benzene, isomer		--		--		--
m-Tolylacetic acid	16000	16		--		--
Indane		--		--		--
Hydroxy Methylacetophenone Isomer		--		--		--
Hexanoic acid, 2-ethyl-, methyl es		--		--		--
Hexadecenoic acid, Z-11-						
Heptadecanoic acid		--		--		--
Heneicosane		--		--		--
Glyceryl monostearate		--		--		--
Ethylmethyl Bezene Isomer		--		--		--
Ethylmethyl Benzene Isomer		--		--		--
Ethyldimethylbenzene, isomer						
Ethyldimethyl Benzene Isomer		--		--		--
Ethenyldimethyl Benzene Isomer		--		--		--
Ethanone, 1-(4-methylphenyl)-		--		--		--
Ethanone, 1-(3-methoxyphenyl)-		--		--		--
Ethanone, 1-(2-methylphenyl)-		--		--		--

	Run 6 - Continued					
	5/5/09		5/6/09		5/7/09	
Analyte Name	**Result (ug/L)**	**Results (mg/L)**	**Result (ug/L)**	**Results (mg/L)**	**Result (ug/L)**	**Results (mg/L)**
Dodecanoic acid		--		--		--
Docosane		--		--		--
Dimethylbenzoic acid, isomer						
Dimethyl Benzoic Acid Isomer		--		--		--
Dibenzyl phthalate		--		--		--
Decane, 3-methyl-	14000	14		--	2300	2.3
Decane, 2-methyl-	25000	25	18000	18	3700	3.7
Decane		--	23000	23		--
Cyclohexane, pentyl-		--		--		--
Cyclohexane, butyl-	40000	40	27000	27		--
Cyclohexane, 1-methyl-3-propyl-		--	21000	21		--
Benzyl methacrylate		--		--		--
Benzoic acid, 3,5-dimethyl-		--		--		--
Benzoic acid, 3,4-dimethyl-		--		--		--
Benzoic acid, 3-methyl-		--		--		--
Benzoic acid, 2,6-dimethyl-		--		--		--
Benzoic acid, 2,5-dimethyl-		--		--		--
Benzenemethanol, .alpha.,4-dimethy		--		--		--
Benzenemethanamine, N,N-dimethyl-		--		--		--
Benzeneacetic acid, alpha.-methyl		--		--		--
Benzene, 4-ethyl-1,2-dimethyl-		--		--		--
Benzene, 2-ethyl-1,4-dimethyl-		--		--		--
Benzene, 2-ethyl-1,3-dimethyl-		--		--		--
Benzene, 1,3,5-trimethyl-		--	22000	22		--
Benzene, 1,3-diethyl-		--		--		--
Benzene, 1,2,4,5-tetramethyl-		--		--	3200	3.2
Benzene, 1,2,4-trimethyl-		--	18000	18		--
Benzene, 1,2,3,5-tetramethyl-		--		--		--
Benzene, 1,2,3-trimethyl-		--	27000	27		--
Benzene, 1,2,3-trimethyl-						

	Run 6 - Continued					
	5/5/09		5/6/09		5/7/09	
Analyte Name	**Result (ug/L)**	**Results (mg/L)**	**Result (ug/L)**	**Results (mg/L)**	**Result (ug/L)**	**Results (mg/L)**
Benzene, 1,2-diethyl-		--		--	2600	2.6
Benzene, 1-methyl-4-propyl-		--		--		--
Benzene, 1-methyl-4-(1-methylethyl		--		--		--
Benzene, 1-methyl-3-propyl-		--		--		--
Benzene, 1-methyl-3-propyl-	13000	13		--		--
Benzene, 1-methyl-3-(1-methylethyl		--		--		--
Benzene, 1-methyl-2-propyl-		--		--		--
Benzene, 1-methyl-2-(1-methylethyl	13000	13		--	3500	3.5
Benzene, 1-ethyl-3,5-dimethyl-		--		--		--
Benzene, 1-ethyl-3-methyl-		--	19000	19		--
Benzene, 1-ethyl-2.4-dimethyl-		--		--		--
Benzene, 1-ethyl-2,3-dimethyl-		--		--		--
Benzene, 1-ethyl-2-methyl-		--	33000	33		--
Benzene, (2-methylpropyl)-		--		--		--
Benzene, (1-methylpropyl)-		--		--		--
Benzene, (1-methylethyl)-		--		--		--
Benzaldehyde, oxime		--		--		--
Benzaldehyde		--		--		--
Acetophenone		--		--		--
9,17-Octadecadienal, (Z)-		--		--		--
9,12-Octadecadienoyl chloride, (Z,	17000	17		--		--
9,12-Octadecadienoic acid(Z,Z)-		--		--		--
9,12-Octadecadienoic acid, methyl		--	22000	22		--
9,12-Octadecadienoic acid (Z,Z)-	18000	18	57000	57	4100	4.1
9-Octadecenoic acid, (E)-		--		--		--
9-Hexadecenoic acid		--		--		--
4-Acetylbenzoic acid		--		--		--
2(3H)-Benzofuranone, 3-methyl-		--		--		--
2,2'-Bipyridine		--		--		--
2-Propenoic acid, 2-methyl-, hexyl		--		--		--

	Run 6 - Continued					
	5/5/09		5/6/09		5/7/09	
Analyte Name	**Result (ug/L)**	**Results (mg/L)**	**Result (ug/L)**	**Results (mg/L)**	**Result (ug/L)**	**Results (mg/L)**
2-Propenoic acid, 2-methyl-, butyl		--		--		--
2-Propenoic acid, 2-methyl-, 2-met		--		--		--
2-Naphthalenol, 1-[(4-methyl-2-nit		--		--	2900	2.9
2-Aminophenacetic acid		--		--		--
2-Amino-3-methylbenzoic acid		--		--		--
2-Acetylbenzoic acid		--		--	2900	2.9
1H-Inden-1-one, 2,3-dihydro-		--		--		--
14-Pentadecenoic acid		--		--		--
1,3-Benzodioxole, 5-propyl-						
1,2-Benzenedicarboxylic acid, ethy	9100	9.1		--	5800	5.8
1,2-Benzenedicarboxylic acid		--		--		--
1-Dodecanamine,N,N-dimethyl-		--		--		--
1-(2-Methoxy-1-methylethyl)-2-meth		--		--		--
Totals	413100	413.1	541000	541	98300	98.3

	Run 6			
	5/8/09		5/22/09	
Analyte Name	**Result (ug/L)**	**Results (mg/L)**	**Result (ug/L)**	**Results (mg/L)**
Unknown Substituted Benzene	2400	2.4		0
Unknown Substituted Aromatic Hydro		--		0
Unknown Substituted Aromatic		--		0
Unknown Organic Acid		--		0
Unknown Ketone		--		0
Unknown Carboxylic Acid	2800	2.8		0
Unknown Branched Cycloalkane	6100	6.1		0
Unknown Branched Alkane	2500	2.5		0
Unknown Aromatic Carboxylic Acid		--		0
Unknown Amine		--	580	0.58
Unknown Alkyl Substituted Alkane		--		0
Unknown Alkane		--		0
Unknown	16000	16	9230	9.23
Undecane, 4-dimethyl-		--		0
Undecane, 3-dimethyl-		--		0
Undecane, 2,6-dimethyl-		--		0
Undecane	6900	6.9	550	0.55
Trimethylbenzene Isomer		--		0
Trimethyl Benzene Isomer		--		0
Pyrrolo[1,2-a]pyrazine,1,4-dione		--		0
Propanoic acid, 3-hydroxy-2,2-dime		--		0
Phthalic Anhydride	8000	8	1900	1.9
Phenol, 3-ethyl-5-methyl-		--		0
Phenol, 3-ethyl-		--		0
Phenol, 2-ethyl-6-methyl-		--		0
Phenol, 2-ethyl-		--		0
Pentadecanoic acid		--		0
p-Tolylacetic acid		--		0
Oxirane, 2-methyl-2-phenyl-		--		0
Oxacycloheptadecan-2-one		--		0

	Run 6 - Continued			
	5/8/09		5/22/09	
Analyte Name	**Result (ug/L)**	**Results (mg/L)**	**Result (ug/L)**	**Results (mg/L)**
Octadecanoic acid, butyl ester		--		0
Octadecanoic acid			460	0.46
Octadec-9-enoic acid		--		0
Oct adecnoic acid, 2-[(1-oxohexade		--		0
o-Tolylacetic acid		--		0
Nonane, 3-methyl-5-propyl-		--		0
Nonane, 3-methyl-		--		0
N,N-Dimethyltetradecanamine		--		0
N-Methyl-N-benzyltetradecanamine		--		0
n-Hexadecanoic acid		--		0
n-Hexadecanoic acid			1500	1.5
n-Dodecylmethyl sulfide		--		0
Methylphenyl Ethanone Isomer		--		0
Methyl(1-methylethyl)benzene, isomer		--		0
m-Tolylacetic acid		--		0
Indane		--		0
Hydroxy Methylacetophenone Isomer		--		0
Hexanoic acid, 2-ethyl-, methyl es		--		0
Hexadecenoic acid, Z-11-			610	0.61
Heptadecanoic acid		--		0
Heneicosane		--		0
Glyceryl monostearate	3000	3		0
Ethylmethyl Bezene Isomer		--		0
Ethylmethyl Benzene Isomer		--		0
Ethyldimethylbenzene, isomer				0
Ethyldimethyl Benzene Isomer		--		0
Ethenyldimethyl Benzene Isomer		--		0
Ethanone, 1-(4-methylphenyl)-		--		0
Ethanone, 1-(3-methoxyphenyl)-		--		0

	Run 6 - Continued			
	5/8/09		5/22/09	
Analyte Name	**Result (ug/L)**	**Results (mg/L)**	**Result (ug/L)**	**Results (mg/L)**
Ethanone, 1-(2-methylphenyl)-		--		0
Dodecanoic acid		--		0
Docosane		--		0
Dimethylbenzoic acid, isomer				0
Dimethyl Benzoic Acid Isomer		--		0
Dibenzyl phthalate		--		0
Decane, 3-methyl-	2800	2.8		0
Decane, 2-methyl-	3500	3.5		0
Decane		--		0
Cyclohexane, pentyl-		--		0
Cyclohexane, butyl-		--		0
Cyclohexane, 1-methyl-3-propyl-		--		0
Benzyl methacrylate		--		0
Benzoic acid, 3,5-dimethyl-		--		0
Benzoic acid, 3,4-dimethyl-		--		0
Benzoic acid, 3-methyl-		--		0
Benzoic acid, 2,6-dimethyl-		--	640	0.64
Benzoic acid, 2,5-dimethyl-		--		0
Benzenemethanol, .alpha.,4-dimethy		--		0
Benzenemethanamine, N,N-dimethyl-		--		0
Benzeneacetic acid, alpha.-methyl		--		0
Benzene, 4-ethyl-1,2-dimethyl-		--		0
Benzene, 2-ethyl-1,4-dimethyl-		--		0
Benzene, 2-ethyl-1,3-dimethyl-		--		0
Benzene, 1,3,5-trimethyl-		--		0
Benzene, 1,3-diethyl-		--		0
Benzene, 1,2,4,5-tetramethyl-		--		0
Benzene, 1,2,4-trimethyl-		--		0
Benzene, 1,2,3,5-tetramethyl-		--		0
Benzene, 1,2,3-trimethyl-		--		0

	Run 6 - Continued			
	5/8/09		5/22/09	
Analyte Name	**Result (ug/L)**	**Results (mg/L)**	**Result (ug/L)**	**Results (mg/L)**
Benzene, 1,2,3-trimethyl-				0
Benzene, 1,2-diethyl-		--		0
Benzene, 1-methyl-4-propyl-		--		0
Benzene, 1-methyl-4-(1-methylethyl		--		0
Benzene, 1-methyl-3-propyl-		--		0
Benzene, 1-methyl-3-propyl-		--		0
Benzene, 1-methyl-3-(1-methylethyl		--		0
Benzene, 1-methyl-2-propyl-		--		0
Benzene, 1-methyl-2-(1-methylethyl	2800	2.8		0
Benzene, 1-ethyl-3,5-dimethyl-		--		0
Benzene, 1-ethyl-3-methyl-		--		0
Benzene, 1-ethyl-2.4-dimethyl-		--		0
Benzene, 1-ethyl-2,3-dimethyl-		--		0
Benzene, 1-ethyl-2-methyl-		--		0
Benzene, (2-methylpropyl)-		--		0
Benzene, (1-methylpropyl)-		--		0
Benzene, (1-methylethyl)-		--		0
Benzaldehyde, oxime		--		0
Benzaldehyde		--		0
Acetophenone		--		0
9,17-Octadecadienal, (Z)-	7600	7.6		0
9,12-Octadecadienoyl chloride, (Z,		--		0
9,12-Octadecadienoic acid(Z,Z)-		--		0
9,12-Octadecadienoic acid, methyl		--		0
9,12-Octadecadienoic acid (Z,Z)-	3900	3.9	4400	4.4
9-Octadecenoic acid, (E)-		--	3700	3.7
9-Hexadecenoic acid		--		0
4-Acetylbenzoic acid		--		0
2(3H)-Benzofuranone, 3-methyl-		--		0
2,2'-Bipyridine		--		0

	Run 6 - Continued			
	5/8/09		5/22/09	
Analyte Name	**Result (ug/L)**	**Results (mg/L)**	**Result (ug/L)**	**Results (mg/L)**
2-Propenoic acid, 2-methyl-, hexyl		--		0
2-Propenoic acid, 2-methyl-, butyl		--		0
2-Propenoic acid, 2-methyl-, 2-met		--		0
2-Naphthalenol, 1-[(4-methyl-2-nit	2700	2.7		0
2-Aminophenacetic acid		--		0
2-Amino-3-methylbenzoic acid		--		0
2-Acetylbenzoic acid		--		0
1H-Inden-1-one, 2,3-dihydro-		--		0
14-Pentadecenoic acid		--		0
1,3-Benzodioxole, 5-propyl-				0
1,2-Benzenedicarboxylic acid, ethy	7000	7	1800	1.8
1,2-Benzenedicarboxylic acid		--		0
1-Dodecanamine,N,N-dimethyl-		--		0
1-(2-Methoxy-1-methylethyl)-2-meth		--		0
Totals	78000	78	25370	25.37

APPENDIX I

VOC'S – AIR PHASE

	BioCan-In 092608		BioCan-Out 092608		GAC-Can 092608	
Compound	**Result**	MRL	**Result**	MRL	**Result**	MRL
	µg/m³	µg/m³	**µg/m³**	µg/m³	**µg/m³**	µg/m³
Propene	ND	870	ND	460	**2.3**	2.2
Dichlorodifluoromethane (CFC 12)	ND	870	ND	460	**3**	2.2
Chloromethane	ND	870	ND	460	ND	2.2
1,2-Dichloro-1,1,2,2-tetrafluoroethane (CFC 114)	ND	870	ND	460	ND	2.2
Vinyl Chloride	ND	870	ND	460	ND	2.2
1,3-Butadiene	ND	870	ND	460	ND	2.2
Bromomethane	ND	870	ND	460	ND	2.2
Chloroethane	ND	870	ND	460	ND	2.2
Ethanol	ND	8,700	ND	4,600	ND	22
Acetonitrile	ND	870	ND	460	ND	2.2
Acrolein	ND	870	ND	460	**2.3**	2.2
Acetone	ND	8,700	ND	4,600	**26**	22
Trichlorofluoromethane	ND	870	ND	460	ND	2.2
2-Propanol (Isopropyl Alcohol)	ND	1,700	ND	910	ND	4.3
Acrylonitrile	ND	870	ND	460	ND	2.2
1,1-Dichloroethene	ND	870	ND	460	ND	2.2
Methylene Chloride	ND	870	ND	460	ND	2.2
3-Chloro-1-propene (Allyl Chloride)	ND	870	ND	460	ND	2.2
Trichlorotrifluoroethane	ND	870	ND	460	ND	2.2
Carbon Disulfide	ND	870	ND	460	ND	2.2
trans-1,2-Dichloroethene	ND	870	ND	460	ND	2.2
1,1-Dichloroethane	ND	870	ND	460	ND	2.2
Methyl tert-Butyl Ether	ND	870	ND	460	ND	2.2
Vinyl Acetate	ND	8,700	ND	4,600	ND	22
2-Butanone (MEK)	ND	870	ND	460	**9.9**	2.2
cis-1,2-Dichloroethene	ND	870	ND	460	ND	2.2

Ethyl Acetate	ND	1,700	ND	910	ND	4.3
n-Hexane	ND	870	ND	460	ND	2.2
Chloroform	ND	870	ND	460	ND	2.2
Tetrahydrofuran (THF)	ND	870	ND	460	**18**	2.2
1,2-Dichloroethane	ND	870	ND	460	ND	2.2
1,1,1-Trichloroethane	ND	870	ND	460	ND	2.2
Benzene	ND	870	720	460	ND	2.2
Carbon Tetrachloride	ND	870	ND	460	ND	2.2
Cyclohexane	ND	1,700	ND	910	ND	4.3
1,2-Dichloropropane	ND	870	ND	460	ND	2.2
Bromodichloromethane	ND	870	ND	460	ND	2.2
Trichloroethene	ND	870	ND	460	ND	2.2
1,4-Dioxane	ND	870	ND	460	ND	2.2
Methyl Methacrylate	ND	1,700	ND	910	ND	4.3
n-Heptane	ND	870	ND	460	ND	2.2
cis-1,3-Dichloropropene	ND	870	ND	460	ND	2.2
4-Methyl-2-pentanone	ND	870	ND	460	ND	2.2
trans-1,3-Dichloropropene	ND	870	ND	460	ND	2.2
1,1,2-Trichloroethane	ND	870	ND	460	ND	2.2
Toluene	**2400**	870	2400	460	**9.3**	2.2
2-Hexanone	ND	870	ND	460	ND	2.2
Dibromochloromethane	ND	870	ND	460	ND	2.2
1,2-Dibromoethane	ND	870	ND	460	ND	2.2
n-Butyl Acetate	ND	870	ND	460	ND	2.2
n-Octane	ND	870	ND	460	ND	2.2
Tetrachloroethene	ND	870	ND	460	ND	2.2
Chlorobenzene	ND	870	ND	460	ND	2.2
Ethylbenzene	**120000**	870	**120000**	460	ND	2.2
m,p-Xylenes	**86000**	1,700	**78000**	910	ND	4.3
Bromoform	ND	870	ND	460	ND	2.2

Styrene	ND	870	ND	460	**21**	2.2
o-Xylene	**41000**	870	**37000**	460	ND	2.2
n-Nonane	**1100**	870	**1100**	460	ND	2.2
1,1,2,2-Tetrachloroethane	ND	870	ND	460	ND	2.2
Cumene	**30000**	870	**28000**	460	ND	2.2
alpha-Pinene	ND	870	ND	460	ND	2.2
n-Propylbenzene	**58000**	870	**48000**	460	ND	2.2
4-Ethyltoluene	**85000**	870	**69000**	460	ND	2.2
1,3,5-Trimethylbenzene	**74000**	870	**51000**	460	ND	2.2
1,2,4-Trimethylbenzene	**140000**	870	**130000**	460	ND	2.2
Benzyl Chloride	ND	870	ND	460	ND	2.2
1,3-Dichlorobenzene	ND	870	ND	460	ND	2.2
1,4-Dichlorobenzene	ND	870	ND	460	ND	2.2
1,2-Dichlorobenzene	ND	870	ND	460	ND	2.2
d-Limonene	ND	870	ND	460	ND	2.2
1,2-Dibromo-3-chloropropane	ND	870	ND	460	ND	2.2
1,2,4-Trichlorobenzene	ND	870	ND	460	ND	2.2
Naphthalene	ND	870	ND	460	ND	2.2
Hexachlorobutadiene	ND	870	ND	460	ND	2.2
Totals	**637500.000**		**565220.000**		**91.800**	
3-Ethyltoluene	**200000.00**					
2-Ethyltoluene	**60000.00**					
1,2,3-Trimethylbenzene	**30000.00**					
C_9H_{10} Compound	**10000.00**					
1-Methyl-propylbenzene Isomers	**9000.00**					
Diethylbenzene Isomers	**10000.00**					
$C_{10}H_{14}$ Aromatic Compound	**6000.00**					
3-Ethyltoluene			**100000**			

2-Ethyltoluene			**50000.00**			
1,2,3-Trimethylbenzene			**20000.00**			
C_9H_{10} Compound			**4000.00**			
Diethylbenzene Isomers			**3000.00**			
1-Methyl-propylbenzene Isomers			**5000.00**			
Diethylbenzene Isomers			**7000.00**			
Difluorochloromethane					**400.00**	
Totals	**962500.00**		**754220.00**		**491.80**	

	BioCan-In 100308		BioCan-Out 100308		GAC-Can 100308	
Compound	**Result**	MRL	**Result**	MRL	**Result**	MRL
	μg/m³	μg/m³	**μg/m³**	μg/m³	**μg/m³**	μg/m³
Propene	ND	2.2	ND	2.3	ND	2.2
Dichlorodifluoromethane (CFC 12)	**2.8**	2.2	**2.9**	2.3	**3**	2.2
Chloromethane	ND	2.2	ND	2.3	ND	2.2
1,2-Dichloro-1,1,2,2-tetrafluoroethane (CFC 114)	ND	2.2	ND	2.3	ND	2.2
Vinyl Chloride	ND	2.2	ND	2.3	ND	2.2
1,3-Butadiene	ND	2.2	ND	2.3	ND	2.2
Bromomethane	ND	2.2	ND	2.3	ND	2.2
Chloroethane	ND	2.2	ND	2.3	ND	2.2
Ethanol	ND	22	ND	23	ND	22
Acetonitrile	ND	2.2	ND	2.3	ND	2.2
Acrolein	**3.1**	2.2	ND	2.3	ND	2.2
Acetone	**28**	22	**25**	23	**48**	22
Trichlorofluoromethane	ND	2.2	ND	2.3	ND	2.2
2-Propanol (Isopropyl Alcohol)	ND	4.4	ND	4.6	ND	4.5
Acrylonitrile	ND	2.2	ND	2.3	ND	2.2
1,1-Dichloroethene	ND	2.2	ND	2.3	ND	2.2
Methylene Chloride	ND	2.2	ND	2.3	ND	2.2
3-Chloro-1-propene (Allyl Chloride)	ND	2.2	ND	2.3	ND	2.2
Trichlorotrifluoroethane	ND	2.2	ND	2.3	ND	2.2
Carbon Disulfide	**5.2**	2.2	ND	2.3	ND	2.2
trans-1,2-Dichloroethene	ND	2.2	ND	2.3	ND	2.2
1,1-Dichloroethane	ND	2.2	ND	2.3	ND	2.2
Methyl tert-Butyl Ether	ND	2.2	ND	2.3	ND	2.2
Vinyl Acetate	ND	22	ND	23	ND	22
2-Butanone (MEK)	**9.6**	2.2	**6.2**	2.3	**14**	2.2
cis-1,2-Dichloroethene	ND	2.2	ND	2.3	ND	2.2

Ethyl Acetate	ND	4.4	ND	4.6	ND	4.5
n-Hexane	ND	2.2	ND	2.3	ND	2.2
Chloroform	ND	2.2	ND	2.3	ND	2.2
Tetrahydrofuran (THF)	ND	2.2	**2.6**	2.3	**19**	2.2
1,2-Dichloroethane	ND	2.2	ND	2.3	ND	2.2
1,1,1-Trichloroethane	ND	2.2	ND	2.3	ND	2.2
Benzene	ND	2.2	ND	2.3	ND	2.2
Carbon Tetrachloride	ND	2.2	ND	2.3	ND	2.2
Cyclohexane	ND	4.4	ND	4.6	ND	4.5
1,2-Dichloropropane	ND	2.2	ND	2.3	ND	2.2
Bromodichloromethane	ND	2.2	ND	2.3	ND	2.2
Trichloroethene	ND	2.2	ND	2.3	ND	2.2
1,4-Dioxane	ND	2.2	ND	2.3	ND	2.2
Methyl Methacrylate	ND	4.4	ND	4.6	ND	4.5
n-Heptane	ND	2.2	ND	2.3	ND	2.2
cis-1,3-Dichloropropene	ND	2.2	ND	2.3	ND	2.2
4-Methyl-2-pentanone	ND	2.2	ND	2.3	ND	2.2
trans-1,3-Dichloropropene	ND	2.2	ND	2.3	ND	2.2
1,1,2-Trichloroethane	ND	2.2	ND	2.3	ND	2.2
Toluene	**2.9**	2.2	**2.3**	2.3	ND	2.2
2-Hexanone	ND	2.2	ND	2.3	ND	2.2
Dibromochloromethane	ND	2.2	ND	2.3	ND	2.2
1,2-Dibromoethane	ND	2.2	ND	2.3	ND	2.2
n-Butyl Acetate	ND	2.2	ND	2.3	ND	2.2
n-Octane	ND	2.2	ND	2.3	ND	2.2
Tetrachloroethene	ND	2.2	ND	2.3	ND	2.2
Chlorobenzene	ND	2.2	ND	2.3	ND	2.2
Ethylbenzene	**190**	2.2	**140**	2.3	ND	2.2
m,p-Xylenes	**140**	4.4	**98**	4.6	ND	4.5
Bromoform	ND	2.2	ND	2.3	ND	2.2

Styrene	ND	2.2	ND	2.3	**6.6**	2.2
o-Xylene	**91**	2.2	**90**	2.3	ND	2.2
n-Nonane	**5.2**	2.2	**3**	2.3	ND	2.2
1,1,2,2-Tetrachloroethane	ND	2.2	ND	2.3	ND	2.2
Cumene	**65**	2.2	**29**	2.3	ND	2.2
alpha-Pinene	ND	2.2	ND	2.3	ND	2.2
n-Propylbenzene	**190**	2.2	**57**	2.3	ND	2.2
4-Ethyltoluene	**380**	2.2	**150**	2.3	ND	2.2
1,3,5-Trimethylbenzene	**410**	2.2	**450**	2.3	ND	2.2
1,2,4-Trimethylbenzene	**1100**	2.2	**920**	2.3	ND	2.2
Benzyl Chloride	ND	2.2	ND	2.3	ND	2.2
1,3-Dichlorobenzene	ND	2.2	ND	2.3	ND	2.2
1,4-Dichlorobenzene	ND	2.2	ND	2.3	ND	2.2
1,2-Dichlorobenzene	ND	2.2	ND	2.3	ND	2.2
d-Limonene	ND	2.2	ND	2.3	ND	2.2
1,2-Dibromo-3-chloropropane	ND	2.2	ND	2.3	ND	2.2
1,2,4-Trichlorobenzene	ND	2.2	ND	2.3	ND	2.2
Naphthalene	**2.8**	2.2	**68**	2.3	ND	2.2
Hexachlorobutadiene	ND	2.2	ND	2.3	ND	2.2
Totals	**2625.600**		**2044.000**		**90.600**	
3-Ethyltoluene	**700.00**					
2-Ethyltoluene	**400.00**					
$C_{10}H_{14}$ Aromatic Compound	**60.00**					
p-Isopropyltoluene	**50.00**					
1,2,3-Trimethylbenzene	**400.00**					
Indane	**100.00**					
$C_{10}H_{14}$ Aromatic Compound	**60.00**					
$C_{10}H_{14}$ Aromatic Compound	**100.00**					

$C_{10}H_{14}$ Aromatic Compound	**200.00**					
$C_{10}H_{14}$ Aromatic Compound	**60.00**					
$C_{10}H_{14}$ Aromatic Compound	**70.00**					
$C_{10}H_{14}$ Aromatic Compound	**60.00**					
$C_{10}H_{14}$ Aromatic Compound	**200.00**					
$C_{10}H_{14}$ Aromatic Compound	**40.00**					
$C_{10}H_{14}$ Aromatic Compound	**70.00**					
3-Ethyltoluene			**500.00**			
2-Ethyltoluene			**500.00**			
1,2,3-Trimethylbenzene			**700.00**			
Indane			**200.00**			
$C_{10}H_{14}$ Aromatic Compound			**70.00**			
$C_{10}H_{14}$ Aromatic Compound			**100.00**			
$C_{10}H_{14}$ Aromatic Compound			**600.00**			
$C_{10}H_{14}$ Aromatic Compound			**200.00**			
$C_{10}H_{14}$ Aromatic Compound			**100.00**			
$C_{10}H_{14}$ Aromatic Compound			**100.00**			
$C_{10}H_{14}$ Aromatic Compound			**500.00**			
$C_{10}H_{14}$ Aromatic Compound			**100.00**			
$C_{10}H_{14}$ Aromatic Compound			**400.00**			
$C_{10}H_{14}$ Aromatic Compound			**600.00**			
$C_{10}H_{14}$ Aromatic Compound			**200.00**			
Unidentified Compound					**10.00**	
n-Pentane					**20.00**	
2-Ethyl-1-hexanol					**10.00**	
Totals	5195.60		6914.00		130.60	
	BioCan-In 100908		BioCan-Out 100908		GAC-Can 100908	

Compound	**Result**	MRL	**Result**	MRL	**Result**	MRL
	µg/m³	µg/m³	**µg/m³**	µg/m³	**µg/m³**	µg/m³
Propene	ND	18	ND	2.3	ND	2.2
Dichlorodifluoromethane (CFC 12)	ND	18	**4.6**	2.3	**2.7**	2.2
Chloromethane	ND	18	ND	2.3	ND	2.2
1,2-Dichloro-1,1,2,2-tetrafluoroethane (CFC 114)	ND	18	ND	2.3	ND	2.2
Vinyl Chloride	ND	18	ND	2.3	ND	2.2
1,3-Butadiene	ND	18	ND	2.3	ND	2.2
Bromomethane	ND	18	ND	2.3	ND	2.2
Chloroethane	ND	18	ND	2.3	ND	2.2
Ethanol	ND	180	ND	23	ND	22
Acetonitrile	ND	18	**5.6**	2.3	ND	2.2
Acrolein	ND	18	ND	2.3	ND	2.2
Acetone	ND	180	ND	23	ND	22
Trichlorofluoromethane	ND	18	**2.4**	2.3	ND	2.2
2-Propanol (Isopropyl Alcohol)	ND	36	ND	4.7	ND	4.4
Acrylonitrile	ND	18	ND	2.3	ND	2.2
1,1-Dichloroethene	ND	18	ND	2.3	ND	2.2
Methylene Chloride	ND	18	**10**	2.3	ND	2.2
3-Chloro-1-propene (Allyl Chloride)	ND	18	ND	2.3	ND	2.2
Trichlorotrifluoroethane	ND	18	ND	2.3	ND	2.2
Carbon Disulfide	ND	18	**4.8**	2.3	**7.8**	2.2
trans-1,2-Dichloroethene	ND	18	ND	2.3	ND	2.2
1,1-Dichloroethane	ND	18	ND	2.3	ND	2.2
Methyl tert-Butyl Ether	ND	18	ND	2.3	ND	2.2
Vinyl Acetate	ND	180	ND	23	ND	22
2-Butanone (MEK)	ND	18	ND	2.3	**6.5**	2.2
cis-1,2-Dichloroethene	ND	18	ND	2.3	ND	2.2
Ethyl Acetate	ND	36	**7**	4.7	ND	4.4

n-Hexane	ND	18	ND	2.3	ND	2.2
Chloroform	ND	18	ND	2.3	ND	2.2
Tetrahydrofuran (THF)	ND	18	ND	2.3	**13**	2.2
1,2-Dichloroethane	ND	18	ND	2.3	ND	2.2
1,1,1-Trichloroethane	ND	18	ND	2.3	ND	2.2
Benzene	ND	18	ND	2.3	ND	2.2
Carbon Tetrachloride	ND	18	ND	2.3	ND	2.2
Cyclohexane	ND	36	ND	4.7	ND	4.4
1,2-Dichloropropane	ND	18	ND	2.3	ND	2.2
Bromodichloromethane	ND	18	ND	2.3	ND	2.2
Trichloroethene	ND	18	ND	2.3	ND	2.2
1,4-Dioxane	ND	18	ND	2.3	ND	2.2
Methyl Methacrylate	ND	36	ND	4.7	ND	4.4
n-Heptane	ND	18	ND	2.3	ND	2.2
cis-1,3-Dichloropropene	ND	18	ND	2.3	ND	2.2
4-Methyl-2-pentanone	ND	18	ND	2.3	ND	2.2
trans-1,3-Dichloropropene	ND	18	ND	2.3	ND	2.2
1,1,2-Trichloroethane	ND	18	ND	2.3	ND	2.2
Toluene	**96**	18	ND	2.3	ND	2.2
2-Hexanone	ND	18	ND	2.3	ND	2.2
Dibromochloromethane	ND	18	ND	2.3	ND	2.2
1,2-Dibromoethane	ND	18	ND	2.3	ND	2.2
n-Butyl Acetate	ND	18	ND	2.3	ND	2.2
n-Octane	ND	18	ND	2.3	ND	2.2
Tetrachloroethene	ND	18	ND	2.3	ND	2.2
Chlorobenzene	ND	18	ND	2.3	ND	2.2
Ethylbenzene	**7500**	18	ND	2.3	ND	2.2
m,p-Xylenes	**5200**	36	ND	4.7	ND	4.4
Bromoform	ND	18	ND	2.3	ND	2.2
Styrene	ND	18	ND	2.3	**4.2**	2.2

o-Xylene	**2600**	18	ND	2.3	ND	2.2
n-Nonane	**93**	18	ND	2.3	ND	2.2
1,1,2,2-Tetrachloroethane	ND	18	ND	2.3	ND	2.2
Cumene	**2500**	18	ND	2.3	ND	2.2
alpha-Pinene	ND	18	ND	2.3	ND	2.2
n-Propylbenzene	**5800**	18	ND	2.3	ND	2.2
4-Ethyltoluene	**10000**	18	ND	2.3	ND	2.2
1,3,5-Trimethylbenzene	**9400**	18	ND	2.3	ND	2.2
1,2,4-Trimethylbenzene	**29000**	18	ND	2.3	ND	2.2
Benzyl Chloride	ND	18	ND	2.3	ND	2.2
1,3-Dichlorobenzene	ND	18	ND	2.3	ND	2.2
1,4-Dichlorobenzene	ND	18	ND	2.3	ND	2.2
1,2-Dichlorobenzene	ND	18	ND	2.3	ND	2.2
d-Limonene	ND	18	ND	2.3	ND	2.2
1,2-Dibromo-3-chloropropane	ND	18	ND	2.3	ND	2.2
1,2,4-Trichlorobenzene	ND	18	ND	2.3	ND	2.2
Naphthalene	ND	18	ND	2.3	ND	2.2
Hexachlorobutadiene	ND	18	ND	2.3	ND	2.2
Totals	**72189.000**		**34.400**		**34.200**	
TICs						
C_9H_{12} Aromatic Compound	**10000.00**					
3-Ethyltoluene	**20000.00**					
C_9H_{12} Aromatic Compound	**10000.00**					
2-Ethyltoluene	**7000.00**					
C_9H_{12} Aromatic Compound	**40000.00**					
$C_{10}H_{14}$ Aromatic Compound	**2000.00**					
1,2,3-Trimethylbenzene	**4000.00**					
p-Isopropyltoluene	**1000.00**					
Indane	**3000.00**					

$C_{10}H_{14}$ Aromatic Compound	**2000.00**					
$C_{10}H_{14}$ Aromatic Compound	**3000.00**					
$C_{10}H_{14}$ Aromatic Compound	**6000.00**					
$C_{10}H_{14}$ Aromatic Compound	**2000.00**					
$C_{10}H_{14}$ Aromatic Compound	**1000.00**					
$C_{10}H_{14}$ Aromatic Compound	**3000.00**					
Fluoroform					**20.00**	
n-Pentane					**20.00**	
2-Ethyl-1-hexanol					**100.00**	
Totals	186189.00		34.40		174.20	

	BioCan-In 121008		BioCan-Out 121008		GAC-Can 121008	
Compound	**Result**	MRL	**Result**	MRL	**Result**	MRL
	µg/m³	µg/m³	**µg/m³**	µg/m³	**µg/m³**	µg/m³
Propene	ND	36	ND	37	4.8	2.2
Dichlorodifluoromethane (CFC 12)	ND	36	ND	37	ND	2.2
Chloromethane	ND	36	ND	37	ND	2.2
1,2-Dichloro-1,1,2,2-tetrafluoroethane (CFC 114)	ND	36	ND	37	ND	2.2
Vinyl Chloride	ND	36	ND	37	ND	2.2
1,3-Butadiene	ND	36	ND	37	ND	2.2
Bromomethane	ND	36	ND	37	ND	2.2
Chloroethane	ND	36	ND	37	ND	2.2
Ethanol	ND	360	ND	370	ND	22
Acetonitrile	ND	36	ND	37	ND	2.2
Acrolein	ND	36	ND	37	ND	2.2
Acetone	460	360	ND	370	38	22
Trichlorofluoromethane	ND	36	ND	37	ND	2.2
2-Propanol (Isopropyl Alcohol)	ND	71	ND	73	ND	4.4
Acrylonitrile	ND	36	ND	37	ND	2.2
1,1-Dichloroethene	ND	36	ND	37	ND	2.2
Methylene Chloride	ND	36	ND	37	ND	2.2
3-Chloro-1-propene (Allyl Chloride)	ND	36	ND	37	ND	2.2
Trichlorotrifluoroethane	ND	36	ND	37	ND	2.2
Carbon Disulfide	ND	36	ND	37	2.5	2.2
trans-1,2-Dichloroethene	ND	36	ND	37	ND	2.2
1,1-Dichloroethane	ND	36	ND	37	ND	2.2
Methyl tert-Butyl Ether	ND	36	ND	37	ND	2.2
Vinyl Acetate	ND	360	ND	370	ND	22
2-Butanone (MEK)	ND	36	ND	37	60	2.2
cis-1,2-Dichloroethene	ND	36	ND	37	ND	2.2

Ethyl Acetate	100	71	ND	73	28	4.4
n-Hexane	77	36	220	37	ND	2.2
Chloroform	ND	36	ND	37	ND	2.2
Tetrahydrofuran (THF)	ND	36	40	37	ND	2.2
1,2-Dichloroethane	ND	36	ND	37	ND	2.2
1,1,1-Trichloroethane	ND	36	ND	37	ND	2.2
Benzene	100	36	190	37	ND	2.2
Carbon Tetrachloride	ND	36	ND	37	ND	2.2
Cyclohexane	ND	71	ND	73	ND	4.4
1,2-Dichloropropane	ND	36	ND	37	ND	2.2
Bromodichloromethane	ND	36	ND	37	ND	2.2
Trichloroethene	ND	36	ND	37	ND	2.2
1,4-Dioxane	ND	36	ND	37	ND	2.2
Methyl Methacrylate	1200	71	87	73	ND	4.4
n-Heptane	ND	36	57	37	ND	2.2
cis-1,3-Dichloropropene	ND	36	ND	37	ND	2.2
4-Methyl-2-pentanone	ND	36	ND	37	ND	2.2
trans-1,3-Dichloropropene	ND	36	ND	37	ND	2.2
1,1,2-Trichloroethane	ND	36	ND	37	ND	2.2
Toluene	29000	36	48000	37	ND	2.2
2-Hexanone	ND	36	ND	37	ND	2.2
Dibromochloromethane	ND	36	ND	37	ND	2.2
1,2-Dibromoethane	ND	36	ND	37	ND	2.2
n-Butyl Acetate	1300	36	ND	37	ND	2.2
n-Octane	ND	36	93	37	ND	2.2
Tetrachloroethene	ND	36	ND	37	ND	2.2
Chlorobenzene	ND	36	ND	37	ND	2.2
Ethylbenzene	46000	36	65000	37	ND	2.2
m,p-Xylenes	47000	71	53000	73	ND	4.4
Bromoform	ND	36	ND	37	ND	2.2

Styrene	ND	36	ND	37	ND	2.2
o-Xylene	25000	36	21000	37	ND	2.2
n-Nonane	230	36	580	37	ND	2.2
1,1,2,2-Tetrachloroethane	ND	36	ND	37	ND	2.2
Cumene	6600	36	5700	37	ND	2.2
alpha-Pinene	ND	36	ND	37	3.2	2.2
n-Propylbenzene	8500	36	7800	37	ND	2.2
4-Ethyltoluene	14000	36	11000	37	ND	2.2
1,3,5-Trimethylbenzene	12000	36	7100	37	ND	2.2
1,2,4-Trimethylbenzene	43000	36	13000	37	ND	2.2
Benzyl Chloride	ND	36	ND	37	ND	2.2
1,3-Dichlorobenzene	ND	36	ND	37	ND	2.2
1,4-Dichlorobenzene	ND	36	ND	37	ND	2.2
1,2-Dichlorobenzene	ND	36	ND	37	ND	2.2
d-Limonene	ND	36	ND	37	ND	2.2
1,2-Dibromo-3-chloropropane	ND	36	ND	37	ND	2.2
1,2,4-Trichlorobenzene	ND	36	ND	37	ND	2.2
Naphthalene	ND	36	ND	37	ND	2.2
Hexachlorobutadiene	ND	36	ND	37	ND	2.2
Totals	**234567.000**		**232867.000**		**136.500**	
TICs						
tert-Butanol	2000.00					
1-Butanol	500.00					
3-Ethyltoluene	30000.00					
C_9H_{12} Aromatic Compound	30000.00					
2-Ethyltoluene	10000.00					
$C_{10}H_{14}$ Aromatic Compound	2000.00					
1,2,3-Trimethylbenzene	7000.00					
p-Isopropyltoluene	1000.00					

Indane	3000.00					
$C_{10}H_{14}$ Aromatic Compound	1000.00					
$C_{10}H_{14}$ Aromatic Compound	3000.00					
$C_{10}H_{14}$ Aromatic Compound	5000.00					
$C_{10}H_{14}$ Aromatic Compound	1000.00					
$C_{10}H_{14}$ Aromatic Compound	1000.00					
$C_{10}H_{14}$ Aromatic Compound	2000.00					
t-Butylperoxide			2,000			
C_9H_{18} Compound			200			
C_9H_{20} Branched Alkane			500			
3-Ethyltoluene			20,000			
2-Ethyltoluene			6,000			
n-Decane			200			
sec-Butylbenzene			400			
$C_{10}H_{14}$ Aromatic Compound			800			
p-Isopropyltoluene			300			
1,2,3-Trimethylbenzene			2,000			
Indane			300			
$C_{10}H_{14}$ Aromatic Compound			400			
$C_{10}H_{14}$ Aromatic Compound			800			
$C_{10}H_{14}$ Aromatic Compound			1,000			
$C_{10}H_{14}$ Aromatic Compound			200			
Chlorodifluoromethane					2,000	
Acetaldehyde + Isobutane					10	
Totals	**333067.00**		**267967.00**		**2146.50**	

	BioCan-In 121908		BioCan-Out 121908		GAC-Can 121908	
Compound	**Result**	MRL	**Result**	MRL	**Result**	MRL
	µg/m³	µg/m³	**µg/m³**	µg/m³	**µg/m³**	µg/m³
Propene	ND	58	ND	19	ND	7.3
Dichlorodifluoromethane (CFC 12)	ND	58	ND	19	ND	7.3
Chloromethane	ND	58	ND	19	ND	7.3
1,2-Dichloro-1,1,2,2-tetrafluoroethane (CFC 114)	ND	58	ND	19	ND	7.3
Vinyl Chloride	ND	58	ND	19	ND	7.3
1,3-Butadiene	ND	58	ND	19	ND	7.3
Bromomethane	ND	58	ND	19	ND	7.3
Chloroethane	ND	58	ND	19	ND	7.3
Ethanol	ND	580	ND	190	ND	73
Acetonitrile	ND	58	ND	19	ND	7.3
Acrolein	ND	58	ND	19	ND	7.3
Acetone	ND	580	ND	190	ND	73
Trichlorofluoromethane	ND	58	ND	19	ND	7.3
2-Propanol (Isopropyl Alcohol)	ND	120	ND	37	ND	15
Acrylonitrile	ND	58	ND	19	ND	7.3
1,1-Dichloroethene	ND	58	ND	19	ND	7.3
Methylene Chloride	ND	58	ND	19	ND	7.3
3-Chloro-1-propene (Allyl Chloride)	ND	58	ND	19	ND	7.3
Trichlorotrifluoroethane	ND	58	ND	19	ND	7.3
Carbon Disulfide	ND	58	ND	19	ND	7.3
trans-1,2-Dichloroethene	ND	58	ND	19	ND	7.3
1,1-Dichloroethane	ND	58	ND	19	ND	7.3
Methyl tert-Butyl Ether	ND	58	ND	19	ND	7.3
Vinyl Acetate	ND	580	ND	190	ND	73
2-Butanone (MEK)	ND	58	ND	19	7.3	7.3
cis-1,2-Dichloroethene	ND	58	ND	19	ND	7.3

Ethyl Acetate	ND	120	ND	37	ND	15
n-Hexane	ND	58	ND	19	ND	7.3
Chloroform	ND	58	ND	19	ND	7.3
Tetrahydrofuran (THF)	ND	58	ND	19	ND	7.3
1,2-Dichloroethane	ND	58	ND	19	ND	7.3
1,1,1-Trichloroethane	ND	58	ND	19	ND	7.3
Benzene	ND	58	ND	19	16	7.3
Carbon Tetrachloride	ND	58	ND	19	ND	7.3
Cyclohexane	ND	120	ND	37	ND	15
1,2-Dichloropropane	ND	58	ND	19	ND	7.3
Bromodichloromethane	ND	58	ND	19	ND	7.3
Trichloroethene	ND	58	ND	19	ND	7.3
1,4-Dioxane	ND	58	ND	19	ND	7.3
Methyl Methacrylate	ND	120	ND	37	ND	15
n-Heptane	ND	58	ND	19	ND	7.3
cis-1,3-Dichloropropene	ND	58	ND	19	ND	7.3
4-Methyl-2-pentanone	ND	58	ND	19	ND	7.3
trans-1,3-Dichloropropene	ND	58	ND	19	ND	7.3
1,1,2-Trichloroethane	ND	58	ND	19	ND	7.3
Toluene	2600	58	950	19	1400	7.3
2-Hexanone	ND	58	ND	19	ND	7.3
Dibromochloromethane	ND	58	ND	19	ND	7.3
1,2-Dibromoethane	ND	58	ND	19	ND	7.3
n-Butyl Acetate	ND	58	ND	19	ND	7.3
n-Octane	ND	58	ND	19	ND	7.3
Tetrachloroethene	ND	58	ND	19	ND	7.3
Chlorobenzene	ND	58	ND	19	ND	7.3
Ethylbenzene	9300	58	2900	19	58	7.3
m,p-Xylenes	16000	120	2300	37	ND	15
Bromoform	ND	58	ND	19	ND	7.3

Styrene	ND	58	ND	19	22	7.3
o-Xylene	11000	58	1300	19	ND	7.3
n-Nonane	ND	58	ND	19	ND	7.3
1,1,2,2-Tetrachloroethane	ND	58	ND	19	ND	7.3
Cumene	2400	58	420	19	ND	7.3
alpha-Pinene	ND	58	ND	19	ND	7.3
n-Propylbenzene	4900	58	460	19	ND	7.3
4-Ethyltoluene	11000	58	650	19	ND	7.3
1,3,5-Trimethylbenzene	13000	58	860	19	ND	7.3
1,2,4-Trimethylbenzene	27000	58	740	19	15	7.3
Benzyl Chloride	ND	58	ND	19	ND	7.3
1,3-Dichlorobenzene	ND	58	ND	19	ND	7.3
1,4-Dichlorobenzene	ND	58	ND	19	ND	7.3
1,2-Dichlorobenzene	ND	58	ND	19	ND	7.3
d-Limonene	ND	58	ND	19	ND	7.3
1,2-Dibromo-3-chloropropane	ND	58	ND	19	ND	7.3
1,2,4-Trichlorobenzene	ND	58	ND	19	ND	7.3
Naphthalene	ND	58	62	19	ND	7.3
Hexachlorobutadiene	ND	58	ND	19	ND	7.3
Totals	**97200.000**		**10642.000**		**1518.300**	
TICs						
3-Ethyltoluene	20000					
2-Ethyltoluene	10000					
Isobutylbenzene	400					
m-Cymene	1000					
1,2,3-Trimethylbenzene	9000					
Indane	2000					
1,3-Diethylbenzene	1000					
m-Propyltoluene	2000					

Ethyl Dimethylbenzene isomers	4000					
o-Propyltoluene	800					
Ethyl Dimethylbenzene isomers	1000					
o-Cymene	1000					
Ethyl Dimethylbenzene isomers	2000					
1,2,4,5-Tetramethylbenzene	500					
1,3,3,4-Tetramethylbenzene	700					
3-Ethyltoluene			2,000			
2-Ethyltoluene			800			
1,2,3-Trimethylbenzene			700			
Indane			100			
Ethyl Dimethylbenzene isomers			300			
Ethyl Dimethylbenzene isomers			200			
tert-Butanol			100			
1,2,4,5-Tetramethylbenzene			200			
1,2,3,4-Tetramethylbenzene			300			
Chlorodifluoromethane					**100**	
tert-Butanol					**100**	
Totals	**152600.00**		**15342.00**		**1718.30**	

	BioCan-In 010809		BioCan-Out 010809		GAC-Can 010809	
Compound	**Result**	MRL	**Result**	MRL	**Result**	MRL
	μg/m³	μg/m³	**μg/m³**	μg/m³	**μg/m³**	μg/m³
Propene	ND	130	ND	76	ND	8.5
Dichlorodifluoromethane (CFC 12)	ND	130	ND	76	ND	8.5
Chloromethane	ND	130	ND	76	ND	8.5
1,2-Dichloro-1,1,2,2-tetrafluoroethane (CFC 114)	ND	130	ND	76	ND	8.5
Vinyl Chloride	ND	130	ND	76	ND	8.5
1,3-Butadiene	ND	130	ND	76	ND	8.5
Bromomethane	ND	130	ND	76	ND	8.5
Chloroethane	ND	130	ND	76	ND	8.5
Ethanol	ND	1,300	ND	760	ND	85
Acetonitrile	ND	130	ND	76	ND	8.5
Acrolein	ND	130	ND	76	ND	8.5
Acetone	ND	1,300	ND	760	ND	85
Trichlorofluoromethane	ND	130	ND	76	ND	8.5
2-Propanol (Isopropyl Alcohol)	ND	260	ND	150	ND	17
Acrylonitrile	ND	130	ND	76	ND	8.5
1,1-Dichloroethene	ND	130	ND	76	ND	8.5
Methylene Chloride	ND	130	ND	76	ND	8.5
3-Chloro-1-propene (Allyl Chloride)	ND	130	ND	76	ND	8.5
Trichlorotrifluoroethane	ND	130	ND	76	ND	8.5
Carbon Disulfide	ND	130	ND	76	ND	8.5
trans-1,2-Dichloroethene	ND	130	ND	76	ND	8.5
1,1-Dichloroethane	ND	130	ND	76	ND	8.5
Methyl tert-Butyl Ether	ND	130	ND	76	ND	8.5
Vinyl Acetate	ND	1,300	ND	760	ND	85
2-Butanone (MEK)	ND	130	ND	76	ND	8.5
cis-1,2-Dichloroethene	ND	130	ND	76	ND	8.5

Ethyl Acetate	ND	260	ND	150	ND	17
n-Hexane	ND	130	ND	76	ND	8.5
Chloroform	ND	130	ND	76	ND	8.5
Tetrahydrofuran (THF)	ND	130	ND	76	ND	8.5
1,2-Dichloroethane	ND	130	ND	76	ND	8.5
1,1,1-Trichloroethane	ND	130	ND	76	ND	8.5
Benzene	ND	130	ND	76	9.8	8.5
Carbon Tetrachloride	ND	130	ND	76	ND	8.5
Cyclohexane	ND	260	ND	150	ND	17
1,2-Dichloropropane	ND	130	ND	76	ND	8.5
Bromodichloromethane	ND	130	ND	76	ND	8.5
Trichloroethene	ND	130	ND	76	ND	8.5
1,4-Dioxane	ND	130	ND	76	ND	8.5
Methyl Methacrylate	ND	260	ND	150	ND	17
n-Heptane	ND	130	ND	76	ND	8.5
cis-1,3-Dichloropropene	ND	130	ND	76	ND	8.5
4-Methyl-2-pentanone	ND	130	ND	76	ND	8.5
trans-1,3-Dichloropropene	ND	130	ND	76	ND	8.5
1,1,2-Trichloroethane	ND	130	ND	76	ND	8.5
Toluene	9100	130	6000	76	1700	8.5
2-Hexanone	ND	130	ND	76	ND	8.5
Dibromochloromethane	ND	130	ND	76	ND	8.5
1,2-Dibromoethane	ND	130	ND	76	ND	8.5
n-Butyl Acetate	ND	130	ND	76	ND	8.5
n-Octane	ND	130	ND	76	ND	8.5
Tetrachloroethene	ND	130	ND	76	ND	8.5
Chlorobenzene	ND	130	ND	76	ND	8.5
Ethylbenzene	34000	130	16000	76	370	8.5
m,p-Xylenes	43000	260	16000	150	78	17
Bromoform	ND	130	ND	76	ND	8.5

Styrene	ND	130	ND	76	170	8.5
o-Xylene	30000	130	8500	76	18	8.5
n-Nonane	210	130	89	76	ND	8.5
1,1,2,2-Tetrachloroethane	ND	130	ND	76	ND	8.5
Cumene	4600	130	2000	76	ND	8.5
alpha-Pinene	ND	130	ND	76	ND	8.5
n-Propylbenzene	10000	130	3200	76	ND	8.5
4-Ethyltoluene	21000	130	5100	76	ND	8.5
1,3,5-Trimethylbenzene	19000	130	3500	76	ND	8.5
1,2,4-Trimethylbenzene	70000	130	7900	76	8.6	8.5
Benzyl Chloride	ND	130	ND	76	ND	8.5
1,3-Dichlorobenzene	ND	130	ND	76	ND	8.5
1,4-Dichlorobenzene	ND	130	ND	76	ND	8.5
1,2-Dichlorobenzene	ND	130	ND	76	ND	8.5
d-Limonene	ND	130	ND	76	ND	8.5
1,2-Dibromo-3-chloropropane	ND	130	ND	76	ND	8.5
1,2,4-Trichlorobenzene	ND	130	ND	76	ND	8.5
Naphthalene	ND	130	ND	76	ND	8.5
Hexachlorobutadiene	ND	130	ND	76	ND	8.5
Totals	**240910.000**		**68289.000**		**2354.400**	
TICs						
3-Ethyltoluene	40,000					
2-Ethyltoluene	20,000					
m-Cymene	1,000					
1,2,3-Trimethylbenzene	10,000					
Indane	3,000					
1,3-Diethylbenzene	1,000					
m-Propyltoluene	3,000					
Ethyldimethylbenzene Isomers	5,000					

o-Propyltoluene	800					
Ethyldimethylbenzene Isomers	2,000					
o-Cymene	1,000					
Ethyldimethylbenzene Isomers	2,000					
3-Ethyltoluene			10,000			
2-Ethyltoluene			3,000			
1,2,3-Trimethylbenzene			1,000			
m-Propyltoluene			400			
Ethyldimethylbenzene Isomers			600			
Chlorodifluoromethane			2,000			
Chlorodifluoromethane					6000.00	
tert-Butanol					70.00	
Benzaldehyde					60.00	
Totals	**329710.00**		**85289.00**		**8484.4**	

	BioCan-In 021009		BioCan-Out 021009		GAC-Can 021009	
Compound	**Result**	MRL	**Result**	MRL	**Result**	MRL
	µg/m³	µg/m³	**µg/m³**	µg/m³	**µg/m³**	µg/m³
Propene	ND	130	ND	79	ND	2.2
Dichlorodifluoromethane (CFC 12)	ND	130	ND	79	2.4	2.2
Chloromethane	ND	130	ND	79	ND	2.2
1,2-Dichloro-1,1,2,2-tetrafluoroethane (CFC 114)	ND	130	ND	79	ND	2.2
Vinyl Chloride	ND	130	ND	79	ND	2.2
1,3-Butadiene	ND	130	ND	79	ND	2.2
Bromomethane	ND	130	ND	79	ND	2.2
Chloroethane	ND	130	ND	79	ND	2.2
Ethanol	ND	1,300	ND	790	ND	22
Acetonitrile	ND	130	ND	79	ND	2.2
Acrolein	ND	130	ND	79	ND	2.2
Acetone	ND	1,300	ND	790	ND	22
Trichlorofluoromethane	ND	130	ND	79	ND	2.2
2-Propanol (Isopropyl Alcohol)	ND	260	ND	160	ND	4.4
Acrylonitrile	ND	130	ND	79	ND	2.2
1,1-Dichloroethene	ND	130	ND	79	ND	2.2
Methylene Chloride	ND	130	ND	79	ND	2.2
3-Chloro-1-propene (Allyl Chloride)	ND	130	ND	79	ND	2.2
Trichlorotrifluoroethane	ND	130	ND	79	ND	2.2
Carbon Disulfide	ND	130	ND	79	3.8	2.2
trans-1,2-Dichloroethene	ND	130	ND	79	ND	2.2
1,1-Dichloroethane	ND	130	ND	79	ND	2.2
Methyl tert-Butyl Ether	ND	130	ND	79	ND	2.2
Vinyl Acetate	ND	1,300	ND	790	ND	22
2-Butanone (MEK)	21	130	ND	79	9.2	2.2
cis-1,2-Dichloroethene	ND	130	ND	79	ND	2.2

Ethyl Acetate	ND	260	ND	160	ND	4.4
n-Hexane	ND	130	ND	79	ND	2.2
Chloroform	ND	130	ND	79	ND	2.2
Tetrahydrofuran (THF)	ND	130	ND	79	ND	2.2
1,2-Dichloroethane	ND	130	ND	79	ND	2.2
1,1,1-Trichloroethane	ND	130	ND	79	ND	2.2
Benzene	ND	130	ND	79	ND	2.2
Carbon Tetrachloride	ND	130	ND	79	ND	2.2
Cyclohexane	ND	260	ND	160	ND	4.4
1,2-Dichloropropane	ND	130	ND	79	ND	2.2
Bromodichloromethane	ND	130	ND	79	ND	2.2
Trichloroethene	ND	130	ND	79	ND	2.2
1,4-Dioxane	ND	130	ND	79	ND	2.2
Methyl Methacrylate	ND	260	ND	160	ND	4.4
n-Heptane	ND	130	ND	79	ND	2.2
cis-1,3-Dichloropropene	ND	130	ND	79	ND	2.2
4-Methyl-2-pentanone	ND	130	ND	79	ND	2.2
trans-1,3-Dichloropropene	ND	130	ND	79	ND	2.2
1,1,2-Trichloroethane	ND	130	ND	79	ND	2.2
Toluene	150	130	100.0	79	7.0	2.2
2-Hexanone	ND	130	ND	79	ND	2.2
Dibromochloromethane	ND	130	ND	79	ND	2.2
1,2-Dibromoethane	ND	130	ND	79	ND	2.2
n-Butyl Acetate	ND	130	ND	79	ND	2.2
n-Octane	ND	130	ND	79	ND	2.2
Tetrachloroethene	ND	130	ND	79	ND	2.2
Chlorobenzene	ND	130	ND	79	ND	2.2
Ethylbenzene	290	130	250.0	79	64.0	2.2
m,p-Xylenes	720	260	540.0	160	49.0	4.4
Bromoform	ND	130	ND	79	ND	2.2

Styrene	ND	130	ND	79	36.0	2.2
o-Xylene	2600	130	4400.0	79	17.0	2.2
n-Nonane	180	130	ND	79	ND	2.2
1,1,2,2-Tetrachloroethane	ND	130	ND	79	ND	2.2
Cumene	140	130	140.0	79	ND	2.2
alpha-Pinene	ND	130	ND	79	ND	2.2
n-Propylbenzene	130	130	150.0	79	ND	2.2
4-Ethyltoluene	2700	130	4300.0	79	2.4	2.2
1,3,5-Trimethylbenzene	5500	130	18000.0	79	6.7	2.2
1,2,4-Trimethylbenzene	4500	130	3300.0	79	2.3	2.2
Benzyl Chloride	ND	130	ND	79	ND	2.2
1,3-Dichlorobenzene	ND	130	ND	79	ND	2.2
1,4-Dichlorobenzene	ND	130	ND	79	ND	2.2
1,2-Dichlorobenzene	ND	130	ND	79	ND	2.2
d-Limonene	ND	130	ND	79	ND	2.2
1,2-Dibromo-3-chloropropane	ND	130	ND	79	ND	2.2
1,2,4-Trichlorobenzene	ND	130	ND	79	ND	2.2
Naphthalene	19	130	ND	79	ND	2.2
Hexachlorobutadiene	ND	130	ND	79	ND	2.2
Totals	**16950.000**		**31180.000**		**199.800**	
TICs						
3-Ethyltoluene	4900.00					
Tetramethylcyclohexane Isomers	230.00					
2-Ethyltoluene	4100.00					
n-Decane	280.00					
m-Cymene	510.00					
1,2,3-Trimethylbenzene	4200.00					
Indane	810.00					
1,3-Diethylbenzene	430.00					

m-Propyltoluene	950.00					
Ethyldimethylbenzene Isomers	1500.00					
o-Propyltoluene	400.00					
Ethyldimethylbenzene Isomers	570.00					
o-Cymene	430					
Ethyldimethylbenzene Isomers	950					
1,2,3,4-Tetramethylbenzene	240					
3-Ethyltoluene			9000.00			
2-Ethyltoluene			13000.00			
m-Cymene			1300			
1,2,3-Trimethylbenzene			21000.00			
Indane			3200			
1,3-Diethylbenzene			1500			
m-Propyltoluene			2800.00			
Ethyldimethylbenzene Isomers			6200.00			
o-Propyltoluene			1500			
Ethyldimethylbenzene Isomers			890			
o-Cymene			840			
Ethyldimethylbenzene Isomers			4600			
Ethyldimethylbenzene Isomers			730.00			
1,2,4,5-Tetramethylbenzene			1300			
1,2,3,4-Tetramethylbenzene			2000			
Chlorodifluoromethane					90	
Carbonyl Sulfide					34	
Totals	**37450.00**		**101040.00**		**323.8**	

	BioCan-In 021809		BioCan-Out 021809		GAC-Can 021809	
Compound	**Result**	MRL	**Result**	MRL	**Result**	MRL
	μg/m³	μg/m³	**μg/m³**	μg/m³	**μg/m³**	μg/m³
Propene	ND	15	ND	6.1	ND	2.1
Dichlorodifluoromethane (CFC 12)	ND	15	ND	6.1	2.3	2.1
Chloromethane	ND	15	ND	6.1	ND	2.1
1,2-Dichloro-1,1,2,2-tetrafluoroethane (CFC 114)	ND	15	ND	6.1	ND	2.1
Vinyl Chloride	ND	15	ND	6.1	ND	2.1
1,3-Butadiene	ND	15	ND	6.1	ND	2.1
Bromomethane	ND	15	ND	6.1	ND	2.1
Chloroethane	ND	15	ND	6.1	ND	2.1
Ethanol	ND	150	ND	61	ND	21
Acetonitrile	ND	15	ND	6.1	ND	2.1
Acrolein	ND	15	ND	6.1	ND	2.1
Acetone	ND	150	ND	61	ND	21
Trichlorofluoromethane	ND	15	ND	6.1	ND	2.1
2-Propanol (Isopropyl Alcohol)	ND	30	ND	12	ND	4.3
Acrylonitrile	ND	15	ND	6.1	ND	2.1
1,1-Dichloroethene	ND	15	ND	6.1	ND	2.1
Methylene Chloride	ND	15	ND	6.1	ND	2.1
3-Chloro-1-propene (Allyl Chloride)	ND	15	ND	6.1	ND	2.1
Trichlorotrifluoroethane	ND	15	ND	6.1	ND	2.1
Carbon Disulfide	ND	15	ND	6.1	ND	2.1
trans-1,2-Dichloroethene	ND	15	ND	6.1	ND	2.1
1,1-Dichloroethane	ND	15	ND	6.1	ND	2.1
Methyl tert-Butyl Ether	ND	15	ND	6.1	ND	2.1
Vinyl Acetate	ND	150	ND	61	ND	21
2-Butanone (MEK)	ND	15	ND	6.1	4.5	2.1
cis-1,2-Dichloroethene	ND	15	ND	6.1	ND	2.1

Ethyl Acetate	ND	30	ND	12	ND	4.3
n-Hexane	ND	15	ND	6.1	ND	2.1
Chloroform	ND	15	ND	6.1	ND	2.1
Tetrahydrofuran (THF)	ND	15	ND	6.1	ND	2.1
1,2-Dichloroethane	ND	15	ND	6.1	ND	2.1
1,1,1-Trichloroethane	ND	15	ND	6.1	ND	2.1
Benzene	ND	15	ND	6.1	2.6	2.1
Carbon Tetrachloride	ND	15	ND	6.1	ND	2.1
Cyclohexane	ND	30	ND	12	ND	4.3
1,2-Dichloropropane	ND	15	ND	6.1	ND	2.1
Bromodichloromethane	ND	15	ND	6.1	ND	2.1
Trichloroethene	ND	15	ND	6.1	ND	2.1
1,4-Dioxane	ND	15	ND	6.1	ND	2.1
Methyl Methacrylate	ND	30	ND	12	ND	4.3
n-Heptane	ND	15	ND	6.1	ND	2.1
cis-1,3-Dichloropropene	ND	15	ND	6.1	ND	2.1
4-Methyl-2-pentanone	ND	15	ND	6.1	ND	2.1
trans-1,3-Dichloropropene	ND	15	ND	6.1	ND	2.1
1,1,2-Trichloroethane	ND	15	ND	6.1	ND	2.1
Toluene	44.0	15	12.0	6.1	34.0	2.1
2-Hexanone	ND	15	ND	6.1	ND	2.1
Dibromochloromethane	ND	15	ND	6.1	ND	2.1
1,2-Dibromoethane	ND	15	ND	6.1	ND	2.1
n-Butyl Acetate	ND	15	ND	6.1	ND	2.1
n-Octane	ND	15	ND	6.1	ND	2.1
Tetrachloroethene	ND	15	ND	6.1	ND	2.1
Chlorobenzene	ND	15	ND	6.1	ND	2.1
Ethylbenzene	84.0	15	16.0	6.1	15.0	2.1
m,p-Xylenes	110.0	30	28.0	12	22.0	4.3
Bromoform	ND	15	ND	6.1	ND	2.1

Styrene	ND	15	ND	6.1	9.3	2.1
o-Xylene	590.0	15	180.0	6.1	7.5	2.1
n-Nonane	25.0	15	ND	6.1	ND	2.1
1,1,2,2-Tetrachloroethane	ND	15	ND	6.1	ND	2.1
Cumene	17.0	15	ND	6.1	ND	2.1
alpha-Pinene	ND	15	ND	6.1	ND	2.1
n-Propylbenzene	26.0	15	ND	6.1	ND	2.1
4-Ethyltoluene	830.0	15	27.0	6.1	ND	2.1
1,3,5-Trimethylbenzene	2200.0	15	680.0	6.1	ND	2.1
1,2,4-Trimethylbenzene	310.0	15	76.0	6.1	ND	2.1
Benzyl Chloride	ND	15	ND	6.1	ND	2.1
1,3-Dichlorobenzene	ND	15	ND	6.1	ND	2.1
1,4-Dichlorobenzene	ND	15	ND	6.1	ND	2.1
1,2-Dichlorobenzene	ND	15	ND	6.1	ND	2.1
d-Limonene	ND	15	ND	6.1	ND	2.1
1,2-Dibromo-3-chloropropane	ND	15	ND	6.1	ND	2.1
1,2,4-Trichlorobenzene	ND	15	ND	6.1	ND	2.1
Naphthalene	ND	15	ND	6.1	ND	2.1
Hexachlorobutadiene	ND	15	ND	6.1	ND	2.1
Totals	**4236.000**		**1019.000**		**97.200**	
TICs						
3-Ethyltoluene	450.00					
2-Ethyltoluene	2000.00					
m-Cymene	340.00					
1,2,3-Trimethylbenzene	2400.00					
Indane	290.00					
1,3-Diethylbenzene	290.00					
m-Propyltoluene	600.00					
Ethyldimethylbenzene Isomers	1100.00					

o-Propyltoluene	260.00					
Ethyldimethylbenzene Isomers	230.00					
o-Cymene	190.00					
Ethyldimethylbenzene Isomers	660.00					
Ethyldimethylbenzene Isomers	130					
1,2,4,5-Tetramethylbenzene	160					
1,2,3,4-Tetramethylbenzene	230					
Chlorodifluoromethane			56.00			
Carbonyl Sulfide			130.00			
3-Ethyltoluene			57			
Tetramethylcyclohexane Isomers			35.00			
2-Ethyltoluene			370			
1,2,3-Trimethylbenzene			970			
Indane			33.00			
Ethyldimethylbenzene Isomers			220.00			
Ethyldimethylbenzene Isomers			31			
Ethyldimethylbenzene Isomers			36			
1,2,4,5-Tetramethylbenzene			60			
1,2,3,4-Tetramethylbenzene			89			
Chlorodifluoromethane					48	
Carbonyl Sulfide					40	
tert-Butanol					23	
Totals	**13566.00**		**3106.00**		**208.2**	

	BioCan-In 022709		BioCan-Out 022709		GAC-Can 022709	
Compound	**Result**	MRL	**Result**	MRL	**Result**	MRL
	µg/m³	µg/m³	**µg/m³**	µg/m³	**µg/m³**	µg/m³
Propene	ND	6.1	ND	6.4	ND	5.8
Dichlorodifluoromethane (CFC 12)	ND	6.1	ND	6.4	ND	5.8
Chloromethane	ND	6.1	ND	6.4	ND	5.8
1,2-Dichloro-1,1,2,2-tetrafluoroethane (CFC 114)	ND	6.1	ND	6.4	ND	5.8
Vinyl Chloride	ND	6.1	ND	6.4	ND	5.8
1,3-Butadiene	ND	6.1	ND	6.4	ND	5.8
Bromomethane	ND	6.1	ND	6.4	ND	5.8
Chloroethane	ND	6.1	ND	6.4	ND	5.8
Ethanol	ND	61	ND	64	ND	58
Acetonitrile	ND	6.1	ND	6.4	ND	5.8
Acrolein	ND	6.1	ND	6.4	ND	5.8
Acetone	ND	61	ND	64	ND	58
Trichlorofluoromethane	ND	6.1	ND	6.4	ND	5.8
2-Propanol (Isopropyl Alcohol)	ND	12	ND	13	ND	12
Acrylonitrile	ND	6.1	ND	6.4	ND	5.8
1,1-Dichloroethene	ND	6.1	ND	6.4	ND	5.8
Methylene Chloride	ND	6.1	ND	6.4	ND	5.8
3-Chloro-1-propene (Allyl Chloride)	ND	6.1	ND	6.4	ND	5.8
Trichlorotrifluoroethane	ND	6.1	ND	6.4	ND	5.8
Carbon Disulfide	ND	6.1	ND	6.4	ND	5.8
trans-1,2-Dichloroethene	ND	6.1	ND	6.4	ND	5.8
1,1-Dichloroethane	ND	6.1	ND	6.4	ND	5.8
Methyl tert-Butyl Ether	ND	6.1	ND	6.4	ND	5.8
Vinyl Acetate	ND	61	ND	64	ND	58
2-Butanone (MEK)	ND	6.1	ND	6.4	7.6	5.8
cis-1,2-Dichloroethene	ND	6.1	ND	6.4	ND	5.8

Ethyl Acetate	ND	12	ND	13	ND	12
n-Hexane	ND	6.1	ND	6.4	ND	5.8
Chloroform	ND	6.1	ND	6.4	ND	5.8
Tetrahydrofuran (THF)	ND	6.1	ND	6.4	ND	5.8
1,2-Dichloroethane	ND	6.1	ND	6.4	ND	5.8
1,1,1-Trichloroethane	ND	6.1	ND	6.4	ND	5.8
Benzene	ND	6.1	ND	6.4	7.9	5.8
Carbon Tetrachloride	ND	6.1	ND	6.4	ND	5.8
Cyclohexane	ND	12	ND	13	ND	12
1,2-Dichloropropane	ND	6.1	ND	6.4	ND	5.8
Bromodichloromethane	ND	6.1	ND	6.4	ND	5.8
Trichloroethene	ND	6.1	ND	6.4	ND	5.8
1,4-Dioxane	ND	6.1	ND	6.4	ND	5.8
Methyl Methacrylate	ND	12	ND	13	ND	12
n-Heptane	ND	6.1	ND	6.4	ND	5.8
cis-1,3-Dichloropropene	ND	6.1	ND	6.4	ND	5.8
4-Methyl-2-pentanone	ND	6.1	ND	6.4	ND	5.8
trans-1,3-Dichloropropene	ND	6.1	ND	6.4	ND	5.8
1,1,2-Trichloroethane	ND	6.1	ND	6.4	ND	5.8
Toluene	2200.0	6.1	430.0	6.4	2300.0	5.8
2-Hexanone	ND	6.1	ND	6.4	ND	5.8
Dibromochloromethane	ND	6.1	ND	6.4	ND	5.8
1,2-Dibromoethane	ND	6.1	ND	6.4	ND	5.8
n-Butyl Acetate	ND	6.1	ND	6.4	ND	5.8
n-Octane	7.8	6.1	ND	6.4	ND	5.8
Tetrachloroethene	ND	6.1	ND	6.4	ND	5.8
Chlorobenzene	ND	6.1	ND	6.4	ND	5.8
Ethylbenzene	2800.0	6.1	190.0	6.4	42.0	5.8
m,p-Xylenes	2000.0	12	45.0	13	ND	12
Bromoform	ND	6.1	ND	6.4	ND	5.8

Styrene	ND	6.1	ND	6.4	8.9	5.8
o-Xylene	2400.0	6.1	630.0	6.4	ND	5.8
n-Nonane	93.0	6.1	ND	6.4	ND	5.8
1,1,2,2-Tetrachloroethane	ND	6.1	ND	6.4	ND	5.8
Cumene	380.0	6.1	ND	6.4	ND	5.8
alpha-Pinene	ND	6.1	ND	6.4	ND	5.8
n-Propylbenzene	560.0	6.1	ND	6.4	ND	5.8
4-Ethyltoluene	1500.0	6.1	20.0	6.4	ND	5.8
1,3,5-Trimethylbenzene	2500.0	6.1	630.0	6.4	ND	5.8
1,2,4-Trimethylbenzene	2700.0	6.1	53.0	6.4	ND	5.8
Benzyl Chloride	ND	6.1	ND	6.4	ND	5.8
1,3-Dichlorobenzene	ND	6.1	ND	6.4	ND	5.8
1,4-Dichlorobenzene	ND	6.1	ND	6.4	ND	5.8
1,2-Dichlorobenzene	ND	6.1	ND	6.4	ND	5.8
d-Limonene	ND	6.1	ND	6.4	ND	5.8
1,2-Dibromo-3-chloropropane	ND	6.1	ND	6.4	ND	5.8
1,2,4-Trichlorobenzene	ND	6.1	ND	6.4	ND	5.8
Naphthalene	ND	6.1	ND	6.4	ND	5.8
Hexachlorobutadiene	ND	6.1	ND	6.4	ND	5.8
Totals	**17140.800**		**1998.000**		**2366.400**	
TICs						
3-Ethyltoluene	5100.00					
2-Ethyltoluene	4400.00					
n-Decane	110.00					
m-Isopropyltoluene	300.00					
1,2,3-Trimethylbenzene	4800.00					
Indane	400.00					
1,2-Diethylbenzene	210.00					
m-Propyltoluene	580.00					

Ethyldimethylbenzene isomers	1000.00					
p-Propyltoluene	220.00					
Ethyldimethylbenzene isomers	250.00					
o-Isopropyltoluene	190.00					
Ethyldimethylbenzene isomers	640					
1,2,4,5,-Tetramethylbenzene	140					
1,2,3,4-Tetramethylbenzene	180					
Chlorodifluoromethane			54.00			
Carbonyl sulfide			78.00			
3-Ethyltoluene			59			
2-Ethyltoluene			360.00			
1,2,3-Trimethylbenzene			1000			
Ethyldimethylbenzene isomers			110			
1,2,3,4-Tetramethylbenzene			45.00		61	
Chlorodifluoromethane					82	
Carbonyl sulfide					54	
tert-Butanol						
Totals	35660.80		3704.00		2563.4	

	BioCan-In 030609		BioCan-Out 030609		GAC-Can 030609	
Compound	**Result**	MRL	**Result**	MRL	**Result**	MRL
	µg/m³	µg/m³	**µg/m³**	µg/m³	**µg/m³**	µg/m³
Propene	ND	350	ND	30	ND	2.2
Dichlorodifluoromethane (CFC 12)	ND	350	ND	30	3.4	2.2
Chloromethane	ND	350	ND	30	ND	2.2
1,2-Dichloro-1,1,2,2-tetrafluoroethane (CFC 114)	ND	350	ND	30	ND	2.2
Vinyl Chloride	ND	350	ND	30	ND	2.2
1,3-Butadiene	ND	350	ND	30	ND	2.2
Bromomethane	ND	350	ND	30	ND	2.2
Chloroethane	ND	350	ND	30	ND	2.2
Ethanol	ND	3,500	ND	300	ND	22
Acetonitrile	ND	350	ND	30	ND	2.2
Acrolein	ND	350	ND	30	ND	2.2
Acetone	ND	3,500	ND	300	ND	22
Trichlorofluoromethane	ND	350	ND	30	ND	2.2
2-Propanol (Isopropyl Alcohol)	ND	710	ND	61	ND	4.4
Acrylonitrile	ND	350	ND	30	ND	2.2
1,1-Dichloroethene	ND	350	ND	30	ND	2.2
Methylene Chloride	ND	350	ND	30	ND	2.2
3-Chloro-1-propene (Allyl Chloride)	ND	350	ND	30	ND	2.2
Trichlorotrifluoroethane	ND	350	ND	30	ND	2.2
Carbon Disulfide	ND	350	ND	30	2.5	2.2
trans-1,2-Dichloroethene	ND	350	ND	30	ND	2.2
1,1-Dichloroethane	ND	350	ND	30	ND	2.2
Methyl tert-Butyl Ether	ND	350	ND	30	ND	2.2
Vinyl Acetate	ND	3,500	ND	300	ND	22
2-Butanone (MEK)	ND	350	ND	30	8.2	2.2
cis-1,2-Dichloroethene	ND	350	ND	30	ND	2.2

Ethyl Acetate	ND	710	ND	61	ND	4.4
n-Hexane	ND	350	ND	30	ND	2.2
Chloroform	ND	350	ND	30	ND	2.2
Tetrahydrofuran (THF)	ND	350	ND	30	ND	2.2
1,2-Dichloroethane	ND	350	ND	30	ND	2.2
1,1,1-Trichloroethane	ND	350	ND	30	ND	2.2
Benzene	ND	350	ND	30	ND	2.2
Carbon Tetrachloride	ND	350	ND	30	ND	2.2
Cyclohexane	ND	710	ND	61	ND	4.4
1,2-Dichloropropane	ND	350	ND	30	ND	2.2
Bromodichloromethane	ND	350	ND	30	ND	2.2
Trichloroethene	ND	350	ND	30	ND	2.2
1,4-Dioxane	ND	350	ND	30	ND	2.2
Methyl Methacrylate	ND	710	ND	61	ND	4.4
n-Heptane	ND	350	ND	30	ND	2.2
cis-1,3-Dichloropropene	ND	350	ND	30	ND	2.2
4-Methyl-2-pentanone	ND	350	ND	30	ND	2.2
trans-1,3-Dichloropropene	ND	350	ND	30	ND	2.2
1,1,2-Trichloroethane	ND	350	ND	30	ND	2.2
Toluene	11000.0	350	8500.0	30	100.0	2.2
2-Hexanone	ND	350	ND	30	ND	2.2
Dibromochloromethane	ND	350	ND	30	ND	2.2
1,2-Dibromoethane	ND	350	ND	30	ND	2.2
n-Butyl Acetate	ND	350	ND	30	ND	2.2
n-Octane	ND	350	61.0	30	ND	2.2
Tetrachloroethene	ND	350	ND	30	ND	2.2
Chlorobenzene	ND	350	ND	30	ND	2.2
Ethylbenzene	34000.0	350	23000.0	30	5.5	2.2
m,p-Xylenes	34000.0	710	18000.0	61	ND	4.4
Bromoform	ND	350	ND	30	ND	2.2

Styrene	ND	350	ND	30	ND	2.2
o-Xylene	19000.0	350	15000.0	30	ND	2.2
n-Nonane	1200.0	350	480.0	30	ND	2.2
1,1,2,2-Tetrachloroethane	ND	350	ND	30	ND	2.2
Cumene	3900.0	350	3400.0	30	ND	2.2
alpha-Pinene	ND	350	ND	30	ND	2.2
n-Propylbenzene	9300.0	350	4500.0	30	ND	2.2
4-Ethyltoluene	19000.0	350	10000.0	30	ND	2.2
1,3,5-Trimethylbenzene	21000.0	350	16000.0	30	ND	2.2
1,2,4-Trimethylbenzene	63000.0	350	12000.0	30	ND	2.2
Benzyl Chloride	ND	350	ND	30	ND	2.2
1,3-Dichlorobenzene	ND	350	ND	30	ND	2.2
1,4-Dichlorobenzene	ND	350	ND	30	ND	2.2
1,2-Dichlorobenzene	ND	350	ND	30	ND	2.2
d-Limonene	ND	350	ND	30	ND	2.2
1,2-Dibromo-3-chloropropane	ND	350	ND	30	ND	2.2
1,2,4-Trichlorobenzene	ND	350	ND	30	ND	2.2
Naphthalene	ND	350	ND	30	ND	2.2
Hexachlorobutadiene	ND	350	ND	30	ND	2.2
Totals	**215400.000**		**110941.000**		**119.600**	
TICs						
1-Butanol	19000.00					
3-Ethyltoluene	42000.00					
2-Ethyltoluene	18000.00					
m-Cymene	2200.00					
1,2,3-Trimethylbenzene	13000.00					
Indane	2900.00					
m-Propyltoluene	3300.00					
Ethyldimethylbenzene Isomers	5200.00					

Ethyldimethylbenzene Isomers	2400.00					
Ethylmethylcyclohexane Isomers			950.00			
Ethylmethylcyclohexane Isomers			940.00			
n-Propylcyclohexane + $C_{10}H_{20}$ Compound			1100			
3-Ethyltoluene			23000.00			
Tetramethylcyclohexane Isomers			1200			
2-Ethyltoluene			15000			
m-Cymene			2100.00			
1,2,3-Trimethylbenzene			15000.00			
Indane			2600			
1,2-Diethylbenzene			1600			
m-Propyltoluene			2900			
Ethyldimethylbenzene Isomers			4100			
o-Propyltoluene			1300.00			
o-Cymene			890			
Ethyldimethylbenzene Isomers			2500			
Chlorodifluoromethane					98	
Carbonyl Sulfide + Propene					22	
Totals	**323400.00**		**186121.00**		**239.6**	

	BioCan-In 031309		BioCan-Out 031309		GAC-Can 031309	
Compound	**Result**	MRL	**Result**	MRL	**Result**	MRL
	μg/m³	μg/m³	**μg/m³**	μg/m³	**μg/m³**	μg/m³
Propene	ND	180	ND	12	ND	2.2
Dichlorodifluoromethane (CFC 12)	ND	180	ND	12	2.7	2.2
Chloromethane	ND	180	ND	12	ND	2.2
1,2-Dichloro-1,1,2,2-tetrafluoroethane (CFC 114)	ND	180	ND	12	ND	2.2
Vinyl Chloride	ND	180	ND	12	ND	2.2
1,3-Butadiene	ND	180	ND	12	ND	2.2
Bromomethane	ND	180	ND	12	ND	2.2
Chloroethane	ND	180	ND	12	ND	2.2
Ethanol	ND	1,800	ND	120	ND	22
Acetonitrile	ND	180	ND	12	ND	2.2
Acrolein	ND	180	ND	12	ND	2.2
Acetone	ND	1,800	ND	120	ND	22
Trichlorofluoromethane	ND	180	ND	12	ND	2.2
2-Propanol (Isopropyl Alcohol)	ND	360	ND	25	ND	4.5
Acrylonitrile	ND	180	ND	12	ND	2.2
1,1-Dichloroethene	ND	180	ND	12	ND	2.2
Methylene Chloride	ND	180	ND	12	ND	2.2
3-Chloro-1-propene (Allyl Chloride)	ND	180	ND	12	ND	2.2
Trichlorotrifluoroethane	ND	180	ND	12	ND	2.2
Carbon Disulfide	250.0	180	ND	12	2.3	2.2
trans-1,2-Dichloroethene	ND	180	ND	12	ND	2.2
1,1-Dichloroethane	ND	180	ND	12	ND	2.2
Methyl tert-Butyl Ether	ND	180	ND	12	ND	2.2
Vinyl Acetate	ND	1,800	ND	120	ND	22
2-Butanone (MEK)	ND	180	ND	12	5.1	2.2
cis-1,2-Dichloroethene	ND	180	ND	12	ND	2.2

Ethyl Acetate	ND	360	ND	25	ND	4.5
n-Hexane	ND	180	ND	12	ND	2.2
Chloroform	ND	180	ND	12	ND	2.2
Tetrahydrofuran (THF)	ND	180	ND	12	ND	2.2
1,2-Dichloroethane	ND	180	ND	12	ND	2.2
1,1,1-Trichloroethane	ND	180	ND	12	ND	2.2
Benzene	ND	180	ND	12	ND	2.2
Carbon Tetrachloride	ND	180	ND	12	ND	2.2
Cyclohexane	ND	360	ND	25	ND	4.5
1,2-Dichloropropane	ND	180	ND	12	ND	2.2
Bromodichloromethane	ND	180	ND	12	ND	2.2
Trichloroethene	ND	180	ND	12	ND	2.2
1,4-Dioxane	ND	180	ND	12	ND	2.2
Methyl Methacrylate	ND	360	ND	25	ND	4.5
n-Heptane	ND	180	ND	12	ND	2.2
cis-1,3-Dichloropropene	ND	180	ND	12	ND	2.2
4-Methyl-2-pentanone	ND	180	ND	12	ND	2.2
trans-1,3-Dichloropropene	ND	180	ND	12	ND	2.2
1,1,2-Trichloroethane	ND	180	ND	12	ND	2.2
Toluene	870.0	180	120.0	12	170.0	2.2
2-Hexanone	ND	180	ND	12	ND	2.2
Dibromochloromethane	ND	180	ND	12	ND	2.2
1,2-Dibromoethane	ND	180	ND	12	ND	2.2
n-Butyl Acetate	ND	180	ND	12	ND	2.2
n-Octane	ND	180	ND	12	ND	2.2
Tetrachloroethene	ND	180	ND	12	ND	2.2
Chlorobenzene	ND	180	ND	12	ND	2.2
Ethylbenzene	3400.0	180	270.0	12	12.0	2.2
m,p-Xylenes	4400.0	360	150.0	25	7.0	4.5
Bromoform	ND	180	ND	12	ND	2.2

Styrene	ND	180	ND	12	ND	2.2
o-Xylene	3800.0	180	590.0	12	2.5	2.2
n-Nonane	640.0	180	ND	12	ND	2.2
1,1,2,2-Tetrachloroethane	ND	180	ND	12	ND	2.2
Cumene	720.0	180	40.0	12	ND	2.2
alpha-Pinene	ND	180	ND	12	ND	2.2
n-Propylbenzene	1800.0	180	38.0	12	ND	2.2
4-Ethyltoluene	7300.0	180	230.0	12	ND	2.2
1,3,5-Trimethylbenzene	10000.0	180	1600.0	12	ND	2.2
1,2,4-Trimethylbenzene	29000.0	180	51.0	12	ND	2.2
Benzyl Chloride	ND	180	ND	12	ND	2.2
1,3-Dichlorobenzene	ND	180	ND	12	ND	2.2
1,4-Dichlorobenzene	ND	180	ND	12	ND	2.2
1,2-Dichlorobenzene	ND	180	ND	12	ND	2.2
d-Limonene	ND	180	ND	12	ND	2.2
1,2-Dibromo-3-chloropropane	ND	180	ND	12	ND	2.2
1,2,4-Trichlorobenzene	ND	180	ND	12	ND	2.2
Naphthalene	ND	180	ND	12	ND	2.2
Hexachlorobutadiene	ND	180	ND	12	ND	2.2
Totals	**62180.000**		**3089.000**		**201.600**	
TICs						
1-Butanol	3100.00					
3-Ethyltoluene	15000.00					
2-Ethyltoluene	9100.00					
Cymene Isomer	2000.00					
1,2,3-Trimethylbenzene	12000.00					
Indane	2700.00					
1,3-Diethylbenzene	1800.00					
Propyltoluene Isomer	4300.00					

Diethylbenzene Isomer+Cymene Isomer	7000.00					
Propyltoluene Isomer	1900.00					
Ethylxylene Isomer	2300.00					
Cymene Isomer	2200.00					
Ethylxylene Isomer	4400					
Tetramethylbenzene Isomer	1200					
Tetramethylbenzene Isomer	1700					
1,1,3-Trimethylcyclohexane			130.00			
1,1,3,5-Tetramethylcyclohexane Isomer+Ethylmethylcyclohexane Isomer			160.00			
Ethylmethylcyclohexane Isomer+ Tetramethylcyclohexane Isomer			160			
3-Ethyltoluene			570.00			
2,6-Dimethyl-2-octene+1,1,2,3-Tetramethylcyclohexane			400			
2-Ethyltoluene			1200			
2,2-Dimethyl-3-octene+1,1,3,3,5-Pentamethylcyclohexane			150.00			
1,2,3-Trimethylbenzene			2100.00			
Indane			210			
Cymene Isomer			610			
Propyltoluene Isomer			240			
Ethylxylene Isomer			290			
Ethylxylene Isomer			150.00			
Tetramethylbenzene Isomer			200			
Tetramethylbenzene Isomer			320			
Difluorochloromethane					85	
Totals	**132880.00**		**9979.00**		**286.6**	

	BioCan-In 032309		BioCan-Out 032309		GAC-Can 032309	
Compound	**Result**	MRL	**Result**	MRL	**Result**	MRL
	µg/m³	µg/m³	**µg/m³**	µg/m³	**µg/m³**	µg/m³
Propene	ND	3.1	ND	2.4	ND	2.2
Dichlorodifluoromethane (CFC 12)	ND	3.1	2.5	2.4	2.5	2.2
Chloromethane	ND	3.1	ND	2.4	ND	2.2
1,2-Dichloro-1,1,2,2-tetrafluoroethane (CFC 114)	ND	3.1	ND	2.4	ND	2.2
Vinyl Chloride	ND	3.1	ND	2.4	ND	2.2
1,3-Butadiene	ND	3.1	ND	2.4	ND	2.2
Bromomethane	ND	3.1	ND	2.4	ND	2.2
Chloroethane	ND	3.1	ND	2.4	ND	2.2
Ethanol	ND	31	ND	24	ND	22
Acetonitrile	5.00	3.1	ND	2.4	ND	2.2
Acrolein	ND	3.1	ND	2.4	4.3	2.2
Acetone	32.0	31	ND	24	120.0	22
Trichlorofluoromethane	ND	3.1	ND	2.4	ND	2.2
2-Propanol (Isopropyl Alcohol)	ND	6.1	ND	4.7	ND	4.4
Acrylonitrile	ND	3.1	ND	2.4	ND	2.2
1,1-Dichloroethene	ND	3.1	ND	2.4	ND	2.2
Methylene Chloride	ND	3.1	ND	2.4	ND	2.2
3-Chloro-1-propene (Allyl Chloride)	ND	3.1	ND	2.4	ND	2.2
Trichlorotrifluoroethane	ND	3.1	ND	2.4	ND	2.2
Carbon Disulfide	ND	3.1	4.1	2.4	17.0	2.2
trans-1,2-Dichloroethene	ND	3.1	ND	2.4	ND	2.2
1,1-Dichloroethane	ND	3.1	ND	2.4	ND	2.2
Methyl tert-Butyl Ether	ND	3.1	ND	2.4	ND	2.2
Vinyl Acetate	ND	31	ND	24	ND	22
2-Butanone (MEK)	7.2	3.1	3.5	2.4	13.0	2.2
cis-1,2-Dichloroethene	ND	3.1	ND	2.4	ND	2.2

Ethyl Acetate	ND	6.1	ND	4.7	ND	4.4
n-Hexane	ND	3.1	ND	2.4	ND	2.2
Chloroform	ND	3.1	ND	2.4	ND	2.2
Tetrahydrofuran (THF)	ND	3.1	ND	2.4	ND	2.2
1,2-Dichloroethane	ND	3.1	ND	2.4	ND	2.2
1,1,1-Trichloroethane	ND	3.1	ND	2.4	ND	2.2
Benzene	ND	3.1	ND	2.4	ND	2.2
Carbon Tetrachloride	ND	3.1	ND	2.4	ND	2.2
Cyclohexane	ND	6.1	ND	4.7	ND	4.4
1,2-Dichloropropane	ND	3.1	ND	2.4	ND	2.2
Bromodichloromethane	ND	3.1	ND	2.4	ND	2.2
Trichloroethene	ND	3.1	ND	2.4	ND	2.2
1,4-Dioxane	ND	3.1	ND	2.4	ND	2.2
Methyl Methacrylate	ND	6.1	ND	4.7	ND	4.4
n-Heptane	ND	3.1	ND	2.4	ND	2.2
cis-1,3-Dichloropropene	ND	3.1	ND	2.4	ND	2.2
4-Methyl-2-pentanone	ND	3.1	ND	2.4	ND	2.2
trans-1,3-Dichloropropene	ND	3.1	ND	2.4	ND	2.2
1,1,2-Trichloroethane	ND	3.1	ND	2.4	ND	2.2
Toluene	8.3	3.1	3.2	2.4	11.0	2.2
2-Hexanone	ND	3.1	ND	2.4	ND	2.2
Dibromochloromethane	ND	3.1	ND	2.4	ND	2.2
1,2-Dibromoethane	ND	3.1	ND	2.4	ND	2.2
n-Butyl Acetate	ND	3.1	ND	2.4	ND	2.2
n-Octane	ND	3.1	ND	2.4	ND	2.2
Tetrachloroethene	ND	3.1	ND	2.4	ND	2.2
Chlorobenzene	ND	3.1	ND	2.4	ND	2.2
Ethylbenzene	37.0	3.1	3.2	2.4	6.3	2.2
m,p-Xylenes	50.0	6.1	6.2	4.7	13.0	4.4
Bromoform	ND	3.1	ND	2.4	ND	2.2

Styrene	ND	3.1	ND	2.4	27.0	2.2
o-Xylene	58.0	3.1	11.0	2.4	7.0	2.2
n-Nonane	44.0	3.1	ND	2.4	ND	2.2
1,1,2,2-Tetrachloroethane	ND	3.1	ND	2.4	ND	2.2
Cumene	13.0	3.1	ND	2.4	ND	2.2
alpha-Pinene	ND	3.1	ND	2.4	ND	2.2
n-Propylbenzene	40.0	3.1	ND	2.4	ND	2.2
4-Ethyltoluene	170.0	3.1	7.8	2.4	ND	2.2
1,3,5-Trimethylbenzene	250.0	3.1	30.0	2.4	ND	2.2
1,2,4-Trimethylbenzene	640.0	3.1	24.0	2.4	2.4	2.2
Benzyl Chloride	ND	3.1	ND	2.4	ND	2.2
1,3-Dichlorobenzene	ND	3.1	ND	2.4	ND	2.2
1,4-Dichlorobenzene	ND	3.1	ND	2.4	ND	2.2
1,2-Dichlorobenzene	ND	3.1	ND	2.4	ND	2.2
d-Limonene	ND	3.1	ND	2.4	ND	2.2
1,2-Dibromo-3-chloropropane	ND	3.1	ND	2.4	ND	2.2
1,2,4-Trichlorobenzene	ND	3.1	ND	2.4	ND	2.2
Naphthalene	4.1	3.1	ND	2.4	ND	2.2
Hexachlorobutadiene	ND	3.1	ND	2.4	ND	2.2
Totals	**1358.600**		**95.500**		**223.500**	
TICs						
tert-Butanol	62.00					
1-Butanol	230.00					
2,6-Dimethyloctane	56.00					
3-Ethyltoluene	350.00					
$C_{10}H_{22}$ Branched Alkane + 1,1,2,3-Tetramethylcyclohexane	65.00					
2-Ethyltoluene	230.00					
n-Decane	99.00					

1,2,3-Trimethylbenzene	340.00					
Indane	91.00					
1,2-Diethylbenzene	57.00					
m-Propyltoluene	130.00					
Ethyldimethylbenzene isomers	210.00					
Ethyldimethylbenzene isomers	53					
o-Isopropyltoluene	55					
Ethyldimethylbenzene isomers	120					
Chlorodifluoromethane			38.00			
Carbonyl Sulfide			83.00			
Hexamethylcyclotrisiloxane			13			
3-Ethyltoluene			17.00			
1,1,2,3-Tetramethylcyclohexane			25			
2-Ethyltoluene			22			
Unidentified Compound			15.00			
2-Ethyl-1-hexanol			17.00			
1,2,3-Trimethylbenzene			120			
Ethyldimethylbenzene isomers			20			
$C_{11}H_{22}$ Compound			18			
Ethyldimethylbenzene isomers			19			
1,2,4,5-Tetramethylbenzene			16.00			
1,2,3,4-Tetamethylbenzene			29			
p-Isopropyltoluene			12			
Chlorodifluoromethane					32	
Acetaldehyde					19	
Totals	**3506.60**		**559.50**		**274.5**	

	BioCan-In 050509		BioCan-Out 050509		GAC-Can 050509	
Compound	**Result**	MRL	**Result**	MRL	**Result**	MRL
	µg/m³	µg/m³	**µg/m³**	µg/m³	**µg/m³**	µg/m³
Propene	ND	36	ND	24	2.8	2.2
Dichlorodifluoromethane (CFC 12)	ND	36	ND	24	2.3	2.2
Chloromethane	ND	36	ND	24	ND	2.2
1,2-Dichloro-1,1,2,2-tetrafluoroethane (CFC 114)	ND	36	ND	24	ND	2.2
Vinyl Chloride	ND	36	ND	24	ND	2.2
1,3-Butadiene	ND	36	ND	24	ND	2.2
Bromomethane	ND	36	ND	24	ND	2.2
Chloroethane	ND	36	ND	24	ND	2.2
Ethanol	3500.0	360	4200.0	240	ND	22
Acetonitrile	ND	36	ND	24	ND	2.2
Acrolein	ND	36	ND	24	ND	2.2
Acetone	ND	360	ND	240	ND	22
Trichlorofluoromethane	ND	36	ND	24	ND	2.2
2-Propanol (Isopropyl Alcohol)	ND	73	ND	47	ND	4.3
Acrylonitrile	ND	36	ND	24	ND	2.2
1,1-Dichloroethene	ND	36	ND	24	ND	2.2
Methylene Chloride	ND	36	ND	24	ND	2.2
3-Chloro-1-propene (Allyl Chloride)	ND	36	ND	24	ND	2.2
Trichlorotrifluoroethane	ND	36	ND	24	ND	2.2
Carbon Disulfide	ND	36	ND	24	14.0	2.2
trans-1,2-Dichloroethene	ND	36	ND	24	ND	2.2
1,1-Dichloroethane	ND	36	ND	24	ND	2.2
Methyl tert-Butyl Ether	ND	36	ND	24	ND	2.2
Vinyl Acetate	ND	360	ND	240	ND	22
2-Butanone (MEK)	260.0	36	91.0	24	8.4	2.2
cis-1,2-Dichloroethene	ND	36	ND	24	ND	2.2

Ethyl Acetate	200.0	73	ND	47	ND	4.3
n-Hexane	ND	36	ND	24	ND	2.2
Chloroform	ND	36	ND	24	ND	2.2
Tetrahydrofuran (THF)	ND	36	ND	24	ND	2.2
1,2-Dichloroethane	ND	36	ND	24	ND	2.2
1,1,1-Trichloroethane	ND	36	ND	24	ND	2.2
Benzene	ND	36	ND	24	ND	2.2
Carbon Tetrachloride	ND	36	ND	24	ND	2.2
Cyclohexane	ND	73	ND	47	ND	4.3
1,2-Dichloropropane	ND	36	ND	24	ND	2.2
Bromodichloromethane	ND	36	ND	24	ND	2.2
Trichloroethene	ND	36	ND	24	ND	2.2
1,4-Dioxane	ND	36	ND	24	ND	2.2
Methyl Methacrylate	ND	73	ND	47	10.0	4.3
n-Heptane	ND	36	47.0	24	ND	2.2
cis-1,3-Dichloropropene	ND	36	ND	24	ND	2.2
4-Methyl-2-pentanone	ND	36	ND	24	ND	2.2
trans-1,3-Dichloropropene	ND	36	ND	24	ND	2.2
1,1,2-Trichloroethane	ND	36	ND	24	ND	2.2
Toluene	450.0	36	570.0	24	27.0	2.2
2-Hexanone	ND	36	ND	24	ND	2.2
Dibromochloromethane	ND	36	ND	24	ND	2.2
1,2-Dibromoethane	ND	36	ND	24	ND	2.2
n-Butyl Acetate	1100.0	36	ND	24	ND	2.2
n-Octane	340.0	36	460.0	24	ND	2.2
Tetrachloroethene	ND	36	ND	24	ND	2.2
Chlorobenzene	ND	36	ND	24	ND	2.2
Ethylbenzene	640.0	36	520.0	24	28.0	2.2
m,p-Xylenes	2200.0	73	1800.0	47	35.0	4.3
Bromoform	ND	36	ND	24	ND	2.2

Styrene	ND	36	ND	24	30.0	2.2
o-Xylene	860.0	36	740.0	24	14.0	2.2
n-Nonane	3600.0	36	3500.0	24	ND	2.2
1,1,2,2-Tetrachloroethane	ND	36	ND	24	ND	2.2
Cumene	260.0	36	210.0	24	ND	2.2
alpha-Pinene	ND	36	ND	24	ND	2.2
n-Propylbenzene	1100.0	36	910.0	24	ND	2.2
4-Ethyltoluene	1900.0	36	1500.0	24	2.2	2.2
1,3,5-Trimethylbenzene	2100.0	36	2000.0	24	ND	2.2
1,2,4-Trimethylbenzene	6000.0	36	4800.0	24	3.2	2.2
Benzyl Chloride	ND	36	ND	24	ND	2.2
1,3-Dichlorobenzene	ND	36	ND	24	ND	2.2
1,4-Dichlorobenzene	ND	36	ND	24	ND	2.2
1,2-Dichlorobenzene	ND	36	ND	24	ND	2.2
d-Limonene	ND	36	ND	24	ND	2.2
1,2-Dibromo-3-chloropropane	ND	36	ND	24	ND	2.2
1,2,4-Trichlorobenzene	ND	36	ND	24	ND	2.2
Naphthalene	57.0	36	ND	24	ND	2.2
Hexachlorobutadiene	ND	36	ND	24	ND	2.2
Totals	**24567.000**		**21348.000**		**176.900**	
TICs						
1-Chloro-4-(trifluoromethyl)-benzene+Ethylcyclohexane	2,000					
Unidentified Compound	1,100					
$C_{10}H_{22}$ Branched Alkane	1,400					
Propylcyclohexane	1,500					
3-Ethyltoluene	3,700					
$C_{10}H_{22}$ Branched Alkane	1,000					
2-Ethyltoluene	1,600					

n-Decane	6,200					
1,2,3-Trimethylbenzene	1,600					
Butylcyclohexane	1,200					
2-Methyldecane	1,000					
3-methyldecane	1,100					
n-Undecane	5,000					
Unidentified Compound	1,200					
n-Dodecane	980					
1-Chloro-4-(trifluoromethyl)-benzene+Ethylcyclohexane			1,700			
1,1,3-Trimethylcyclohexane			760			
3-Methyloctane			920			
1-Ethyl-3-methylcyclohexane Isomer			960			
Ethylmethylcyclohexane Isomer			890			
Unidentified Compound			900			
$C_{10}H_{22}$ Branched Alkane			1,100			
Propylcyclohexane			1,300			
3-Ethyltoluene			3,300			
$C_{10}H_{22}$ Branched Alkane			710			
$C_{10}H_{20}$ Compound			770			
2-Ethyltoluene			1,500			
n-Decane			3,600			
1,2,3-Trimethylbenzene			1,500			
n-Undecane			2,200			
Difluorochloromethane					100	
Hexamethylcyclotrisiloxane					28	
Totals	**55147.00**		**43458.00**		**304.9**	

	BioCan-In 050609		BioCan-Out 050609	
Compound	**Result**	MRL	**Result**	MRL
	µg/m³	µg/m³	**µg/m³**	µg/m³
Propene	ND	560	ND	190
Dichlorodifluoromethane (CFC 12)	ND	560	ND	190
Chloromethane	ND	560	ND	190
1,2-Dichloro-1,1,2,2-tetrafluoroethane (CFC 114)	ND	560	ND	190
Vinyl Chloride	ND	560	ND	190
1,3-Butadiene	ND	560	ND	190
Bromomethane	ND	560	ND	190
Chloroethane	ND	560	ND	190
Ethanol	ND	5,600	ND	1,900
Acetonitrile	ND	560	ND	190
Acrolein	ND	560	ND	190
Acetone	ND	5,600	ND	1,900
Trichlorofluoromethane	ND	560	ND	190
2-Propanol (Isopropyl Alcohol)	ND	1,100	ND	390
Acrylonitrile	ND	560	ND	190
1,1-Dichloroethene	ND	560	ND	190
Methylene Chloride	ND	560	ND	190
3-Chloro-1-propene (Allyl Chloride)	ND	560	ND	190
Trichlorotrifluoroethane	ND	560	ND	190
Carbon Disulfide	ND	560	ND	190
trans-1,2-Dichloroethene	ND	560	ND	190
1,1-Dichloroethane	ND	560	ND	190
Methyl tert-Butyl Ether	ND	560	ND	190
Vinyl Acetate	ND	5,600	ND	1,900
2-Butanone (MEK)	3900.0	560	ND	190
cis-1,2-Dichloroethene	ND	560	ND	190

Ethyl Acetate	ND	1,100	ND	390
n-Hexane	ND	560	ND	190
Chloroform	ND	560	ND	190
Tetrahydrofuran (THF)	ND	560	ND	190
1,2-Dichloroethane	ND	560	ND	190
1,1,1-Trichloroethane	ND	560	ND	190
Benzene	1100.0	560	660.0	190
Carbon Tetrachloride	ND	560	ND	190
Cyclohexane	ND	1,100	ND	390
1,2-Dichloropropane	ND	560	ND	190
Bromodichloromethane	ND	560	ND	190
Trichloroethene	ND	560	ND	190
1,4-Dioxane	ND	560	ND	190
Methyl Methacrylate	ND	1,100	ND	390
n-Heptane	1800.0	560	1600.0	190
cis-1,3-Dichloropropene	ND	560	ND	190
4-Methyl-2-pentanone	ND	560	ND	190
trans-1,3-Dichloropropene	ND	560	ND	190
1,1,2-Trichloroethane	ND	560	ND	190
Toluene	32000.0	560	13000.0	190
2-Hexanone	ND	560	ND	190
Dibromochloromethane	ND	560	ND	190
1,2-Dibromoethane	ND	560	ND	190
n-Butyl Acetate	ND	560	ND	190
n-Octane	12000.0	560	8200.0	190
Tetrachloroethene	ND	560	ND	190
Chlorobenzene	ND	560	ND	190
Ethylbenzene	23000.0	560	8500.0	190
m,p-Xylenes	68000.0	1,100	24000.0	390
Bromoform	ND	560	ND	190

Styrene	ND	560	ND	190
o-Xylene	20000.0	560	7200.0	190
n-Nonane	77000.0	560	40000.0	190
1,1,2,2-Tetrachloroethane	ND	560	ND	190
Cumene	3300.0	560	1200.0	190
alpha-Pinene	ND	560	ND	190
n-Propylbenzene	7400.0	560	2500.0	190
4-Ethyltoluene	11000.0	560	3900.0	190
1,3,5-Trimethylbenzene	11000.0	560	3200.0	190
1,2,4-Trimethylbenzene	26000.0	560	5300.0	190
Benzyl Chloride	ND	560	ND	190
1,3-Dichlorobenzene	ND	560	ND	190
1,4-Dichlorobenzene	ND	560	ND	190
1,2-Dichlorobenzene	ND	560	ND	190
d-Limonene	ND	560	ND	190
1,2-Dibromo-3-chloropropane	ND	560	ND	190
1,2,4-Trichlorobenzene	ND	560	ND	190
Naphthalene	ND	560	ND	190
Hexachlorobutadiene	ND	560	ND	190
Totals	**297500.000**		**119260.000**	
TICs				
1,1,3-Trimethylcyclohexane	18,000			
Trimethylcyclohexane Isomer +2,3-Dimethylheptane	18,000			
3-Methyloctane	21,000			
Methylcyclooctane	7,600			
1-Ethyl-4-methylcyclohexane	14,000			
Ethylmethylcyclohexane Isomer	19,000			
Cyclohexanepropanol + Unidentified Compound	19,000			

2,6-Dimethyloctane	23,000			
Propylcyclohexane	21,000			
$C_{10}H_{22}$ Branched Alkane	9,600			
3-Ethyltoluene	25,000			
$C_{10}H_{20}$ Compound	26,000			
n-Decane	52,000			
Butylcyclohexane	9,300			
n-Undecane	9,000			
C_9H_{20} Branched Alkane			4,000	
Chlorobenzotrifluoride Isomer			15,000	
1,1,3-Trimethylcyclohexane			11,000	
Trimethylcyclohexane Isomer + 2,3-Dimethylheptane			9,900	
1,2,4-Trimethylcyclohexane			4,900	
1-Ethyl-4-methylcyclohexane			7,200	
Ethylmethylcyclohexane Isomer			9,100	
Cyclohexanepropanol + Unidentified Compound			9,000	
2,6-Dimethyloctane			11,000	
Propylcyclohexane			9,500	
$C_{10}H_{22}$ Branched Alkane			4,500	
3-Ethyltoluene			8,200	
$C_{10}H_{20}$ Compound			11,000	
n-Decane			23,000	
Butylcyclohexane			4,000	
C10H22 Branched Alkane				
n-Propylcyclohexane				
4-Methylnonane				
C10H22 + C9H18 Compound				

n-Decane				
1,2,3-Trimethylbenzene				
n-Butylcyclohexane				
Ethyldimethylbenzene Isomers				
2-Methyldecane				
o-Propyltoluene				
3-Methyldecane				
o-Cymene				
Ethyldimethylbenzene Isomers				
n-Undecane				
Ethyldimethylbenzene Isomers				
Totals	**589000.00**		**260560.00**	

	BioCan-In 050809		BioCan-Out 050809		GAC-Can 050809	
Compound	**Result**	MRL	**Result**	MRL	**Result**	MRL
	µg/m³	µg/m³	**µg/m³**	µg/m³	**µg/m³**	µg/m³
Propene	ND	68	ND	71	ND	2.1
Dichlorodifluoromethane (CFC 12)	ND	68	ND	71	ND	2.1
Chloromethane	ND	68	ND	71	ND	2.1
1,2-Dichloro-1,1,2,2-tetrafluoroethane (CFC 114)	ND	68	ND	71	ND	2.1
Vinyl Chloride	ND	68	ND	71	ND	2.1
1,3-Butadiene	ND	68	ND	71	ND	2.1
Bromomethane	ND	68	ND	71	ND	2.1
Chloroethane	ND	68	ND	71	ND	2.1
Ethanol	ND	680	ND	710	56.0	21
Acetonitrile	ND	68	ND	71	2.20	2.1
Acrolein	ND	68	ND	71	ND	2.1
Acetone	ND	680	ND	710	62.0	21
Trichlorofluoromethane	ND	68	ND	71	ND	2.1
2-Propanol (Isopropyl Alcohol)	ND	140	ND	140	ND	4.3
Acrylonitrile	ND	68	ND	71	ND	2.1
1,1-Dichloroethene	ND	68	ND	71	ND	2.1
Methylene Chloride	ND	68	ND	71	ND	2.1
3-Chloro-1-propene (Allyl Chloride)	ND	68	ND	71	ND	2.1
Trichlorotrifluoroethane	ND	68	ND	71	ND	2.1
Carbon Disulfide	ND	68	ND	71	7.4	2.1
trans-1,2-Dichloroethene	ND	68	ND	71	ND	2.1
1,1-Dichloroethane	ND	68	ND	71	ND	2.1
Methyl tert-Butyl Ether	ND	68	ND	71	ND	2.1
Vinyl Acetate	ND	680	ND	710	ND	21
2-Butanone (MEK)	1100.0	68	320.0	71	9.4	2.1
cis-1,2-Dichloroethene	ND	68	ND	71	ND	2.1
Ethyl Acetate	ND	140	ND	140	ND	4.3
n-Hexane	ND	68	ND	71	ND	2.1

Chloroform	ND	68	ND	71	ND	2.1
Tetrahydrofuran (THF)	ND	68	ND	71	ND	2.1
1,2-Dichloroethane	ND	68	ND	71	ND	2.1
1,1,1-Trichloroethane	ND	68	ND	71	ND	2.1
Benzene	ND	68	ND	71	ND	2.1
Carbon Tetrachloride	ND	68	ND	71	ND	2.1
Cyclohexane	ND	140	ND	140	ND	4.3
1,2-Dichloropropane	ND	68	ND	71	ND	2.1
Bromodichloromethane	ND	68	ND	71	ND	2.1
Trichloroethene	ND	68	ND	71	ND	2.1
1,4-Dioxane	ND	68	ND	71	ND	2.1
Methyl Methacrylate	ND	140	ND	140	ND	4.3
n-Heptane	ND	68	ND	71	ND	2.1
cis-1,3-Dichloropropene	ND	68	ND	71	ND	2.1
4-Methyl-2-pentanone	ND	68	ND	71	ND	2.1
trans-1,3-Dichloropropene	ND	68	ND	71	ND	2.1
1,1,2-Trichloroethane	ND	68	ND	71	ND	2.1
Toluene	ND	68	ND	71	8.1	2.1
2-Hexanone	ND	68	ND	71	ND	2.1
Dibromochloromethane	ND	68	ND	71	ND	2.1
1,2-Dibromoethane	ND	68	ND	71	ND	2.1
n-Butyl Acetate	ND	68	ND	71	ND	2.1
n-Octane	660.0	68	680.0	71	2.7	2.1
Tetrachloroethene	ND	68	ND	71	ND	2.1
Chlorobenzene	ND	68	ND	71	ND	2.1
Ethylbenzene	ND	68	140.0	71	13.0	2.1
m,p-Xylenes	240.0	140	420.0	140	28.0	4.3
Bromoform	ND	68	ND	71	ND	2.1
Styrene	ND	68	110.0	71	38.0	2.1
o-Xylene	120.0	68	250.0	71	12.0	2.1
n-Nonane	11000.0	68	11000.0	71	2.7	2.1
1,1,2,2-Tetrachloroethane	ND	68	ND	71	ND	2.1

Cumene	86.0	68	110.0	71	ND	2.1
alpha-Pinene	ND	68	ND	71	2.3	2.1
n-Propylbenzene	590.0	68	650.0	71	ND	2.1
4-Ethyltoluene	1400.0	68	1700.0	71	ND	2.1
1,3,5-Trimethylbenzene	2500.0	68	3300.0	71	ND	2.1
1,2,4-Trimethylbenzene	9100.0	68	5700.0	71	ND	2.1
Benzyl Chloride	ND	68	ND	71	ND	2.1
1,3-Dichlorobenzene	ND	68	ND	71	ND	2.1
1,4-Dichlorobenzene	ND	68	ND	71	ND	2.1
1,2-Dichlorobenzene	ND	68	ND	71	ND	2.1
d-Limonene	ND	68	ND	71	ND	2.1
1,2-Dibromo-3-chloropropane	ND	68	ND	71	ND	2.1
1,2,4-Trichlorobenzene	ND	68	ND	71	ND	2.1
Naphthalene	240.0	68	ND	71	ND	2.1
Hexachlorobutadiene	ND	68	ND	71	ND	2.1
Totals	**27036.000**		**24380.000**		**243.800**	
TICs						
1,1,3-Trimethylcyclohexane	5,300					
Trimethylcyclohexane Isomer +2,3-Dimethylheptane	5,800					
3-Methyloctane	4,600					
Methylcyclooctane	9,200					
1-Ethyl-4-methylcyclohexane	24,000					
Ethylmethylcyclohexane Isomer	3,200					
Cyclohexanepropanol + Unidentified Compound	4,800					
2,6-Dimethyloctane	4,800					
Propylcyclohexane	4,000					
$C_{10}H_{22}$ Branched Alkane	4,100					
3-Ethyltoluene	4,900					
$C_{10}H_{20}$ Compound	4,300					
n-Decane	3,600					

Butylcyclohexane	18,000					
n-Undecane	4,600					
Unidentified Compound			3,600			
C10H22 Branched Alkane			5,500			
n-Propylcyclohexane			6,200			
3-Ethyltoluene			3,500			
4-Methylnonane			4,500			
C10H22 + C9H18 Compound			9,200			
n-Decane			20,000			
n-Butylcyclohexane			4,300			
Ethyldimethylbenzene Isomers			4,400			
o-Propyltoluene			3,400			
3-Methyldecane			3,100			
o-Cymene + Decahydronaphthalene Isomers			3,600			
n-Undecane			7,400			
Unidentified Compound			3,400			
Ethyldimethylbenzene Isomers			3,800			
Chlorodifluoromethane					51	
Carbonyl Sulfide					50	
Acetaldehyde					13	
n-Pentane					11	
Pentanal + Cyclopentanol					14	
Totals	**132236.00**		**110280.00**		**382.8**	

	BioCan-In 052209		BioCan-Out 052209		GAC-Can 052209	
Compound	**Result**	MRL	**Result**	MRL	**Result**	MRL
	μg/m³	μg/m³	**μg/m³**	μg/m³	**μg/m³**	μg/m³
Propene	ND	2.2	ND	2.3	ND	2.2
Dichlorodifluoromethane (CFC 12)	2.3	2.2	2.4	2.3	2.5	2.2
Chloromethane	ND	2.2	ND	2.3	ND	2.2
1,2-Dichloro-1,1,2,2-tetrafluoroethane (CFC 114)	ND	2.2	ND	2.3	ND	2.2
Vinyl Chloride	ND	2.2	ND	2.3	ND	2.2
1,3-Butadiene	ND	2.2	ND	2.3	ND	2.2
Bromomethane	ND	2.2	ND	2.3	ND	2.2
Chloroethane	ND	2.2	ND	2.3	ND	2.2
Ethanol	89.0	22	ND	23	ND	22
Acetonitrile	6.50	2.2	ND	2.3	ND	2.2
Acrolein	2.3	2.2	2.6	2.3	ND	2.2
Acetone	35.0	22	55.0	23	32.0	22
Trichlorofluoromethane	ND	2.2	ND	2.3	ND	2.2
2-Propanol (Isopropyl Alcohol)	ND	4.4	ND	4.6	ND	4.3
Acrylonitrile	ND	2.2	ND	2.3	ND	2.2
1,1-Dichloroethene	ND	2.2	ND	2.3	ND	2.2
Methylene Chloride	ND	2.2	ND	2.3	ND	2.2
3-Chloro-1-propene (Allyl Chloride)	ND	2.2	ND	2.3	ND	2.2
Trichlorotrifluoroethane	ND	2.2	ND	2.3	ND	2.2
Carbon Disulfide	ND	2.2	5.6	2.3	3.9	2.2
trans-1,2-Dichloroethene	ND	2.2	ND	2.3	ND	2.2
1,1-Dichloroethane	ND	2.2	ND	2.3	ND	2.2
Methyl tert-Butyl Ether	ND	2.2	ND	2.3	ND	2.2
Vinyl Acetate	ND	22	ND	23	ND	22
2-Butanone (MEK)	39.0	2.2	9.1	2.3	18.0	2.2
cis-1,2-Dichloroethene	ND	2.2	ND	2.3	ND	2.2

Ethyl Acetate	4.7	4.4	ND	4.6	ND	4.3
n-Hexane	ND	2.2	ND	2.3	6.6	2.2
Chloroform	ND	2.2	ND	2.3	ND	2.2
Tetrahydrofuran (THF)	ND	2.2	ND	2.3	ND	2.2
1,2-Dichloroethane	ND	2.2	ND	2.3	ND	2.2
1,1,1-Trichloroethane	ND	2.2	ND	2.3	ND	2.2
Benzene	ND	2.2	ND	2.3	16.0	2.2
Carbon Tetrachloride	ND	2.2	ND	2.3	ND	2.2
Cyclohexane	ND	4.4	ND	4.6	ND	4.3
1,2-Dichloropropane	ND	2.2	ND	2.3	ND	2.2
Bromodichloromethane	ND	2.2	ND	2.3	ND	2.2
Trichloroethene	ND	2.2	ND	2.3	ND	2.2
1,4-Dioxane	ND	2.2	ND	2.3	ND	2.2
Methyl Methacrylate	ND	4.4	ND	4.6	ND	4.3
n-Heptane	ND	2.2	ND	2.3	11.0	2.2
cis-1,3-Dichloropropene	ND	2.2	ND	2.3	ND	2.2
4-Methyl-2-pentanone	ND	2.2	ND	2.3	ND	2.2
trans-1,3-Dichloropropene	ND	2.2	ND	2.3	ND	2.2
1,1,2-Trichloroethane	ND	2.2	ND	2.3	ND	2.2
Toluene	7.6	2.2	3.7	2.3	140.0	2.2
2-Hexanone	ND	2.2	ND	2.3	ND	2.2
Dibromochloromethane	ND	2.2	ND	2.3	ND	2.2
1,2-Dibromoethane	ND	2.2	ND	2.3	ND	2.2
n-Butyl Acetate	12.0	2.2	ND	2.3	ND	2.2
n-Octane	2.9	2.2	ND	2.3	ND	2.2
Tetrachloroethene	ND	2.2	ND	2.3	ND	2.2
Chlorobenzene	ND	2.2	ND	2.3	ND	2.2
Ethylbenzene	5.7	2.2	3.4	2.3	11.0	2.2
m,p-Xylenes	18.0	4.4	6.0	4.6	8.4	4.3
Bromoform	ND	2.2	ND	2.3	ND	2.2

Styrene	ND	2.2	ND	2.3	26.0	2.2
o-Xylene	9.4	2.2	5.5	2.3	4.5	2.2
n-Nonane	34.0	2.2	8.4	2.3	ND	2.2
1,1,2,2-Tetrachloroethane	ND	2.2	ND	2.3	ND	2.2
Cumene	2.2	2.2	ND	2.3	ND	2.2
alpha-Pinene	ND	2.2	ND	2.3	ND	2.2
n-Propylbenzene	9.2	2.2	4.2	2.3	ND	2.2
4-Ethyltoluene	19.0	2.2	8.6	2.3	ND	2.2
1,3,5-Trimethylbenzene	24.0	2.2	16.0	2.3	ND	2.2
1,2,4-Trimethylbenzene	59.0	2.2	12.0	2.3	ND	2.2
Benzyl Chloride	ND	2.2	ND	2.3	ND	2.2
1,3-Dichlorobenzene	ND	2.2	ND	2.3	ND	2.2
1,4-Dichlorobenzene	ND	2.2	ND	2.3	ND	2.2
1,2-Dichlorobenzene	ND	2.2	ND	2.3	ND	2.2
d-Limonene	ND	2.2	ND	2.3	ND	2.2
1,2-Dibromo-3-chloropropane	ND	2.2	ND	2.3	ND	2.2
1,2,4-Trichlorobenzene	ND	2.2	ND	2.3	ND	2.2
Naphthalene	5.0	2.2	ND	2.3	ND	2.2
Hexachlorobutadiene	ND	2.2	ND	2.3	ND	2.2
Totals	**386.800**		**142.500**		**279.900**	
TICs						
1-Butanol	26					
1-Methoxy-2-propanol	31					
C10H22 Branched Alkane	24					
3-Ethyltoluene	36					
n-Decane	86					
1,2,3-Trimethylbenzene+4-Methyldecane	80					
Propyltoluene Isomer	24					
1,4-Diethylbenzene+C11H24 Branched Alkane	37					

C11H24 Branched Alkane	24					
C11H24 Branched Alkane	30					
n-Undecane	140					
Ethylxylene Isomer+C11H22 Compound	35					
C12H26 Branched Alkane	24					
C12H26 Branched Alkane+1,2,4,5-Tetramethylbenzene	25					
n-Dodecane	61					
Difluorochloromethane+Carbonyl sulfide			34			
Acetaldehyde + Isobutane			12			
Hexamethylcyclotrisiloxane			59			
1-Chloro-4-(trifluoromethyl)benzene+Ethylcyclohexane			12			
Propylcyclohexane			12			
3-Ethyltoluene			16			
2,6-Dimethyl-2-octene+1-Ethyl-2,3-dimethylcyclohexane			21			
n-Decane			23			
1,2,3-Trimethylbenzene+C11H22 Compound			14			
Propyltoluene Isomer			13			
Ethylxylene Isomer			16			
n-Undecane			19			
Ethylxylene Isomer+C11H22 Compound			17			
Difluorochloromethane					26	
C4H8 Alkene					13	
tert-Butanol					37	
3-Methylhexane					14	
Methylcyclohexane					67	

1,3-Dimethylcyclohexane					20	
1,1-Dimethylcyclohexane					15	
1,2-Dimethylcyclohexane					18	
1,4-Dimethylcyclohexane					31	
Ethylcyclohexane					53	
1,1,3-Trimethylcyclohexane					11	
Octahydropentalene					56	
Bicyclo[3.2.1]octane					33	
Decanal					15	
Totals	**1069.80**		**410.50**		**688.9**	

APPENDIX J

SLUDGE DATA

Analyte	Sample 1 results (mg/L)	Sample 2 results (mg/L)	Sample 3 results (mg/L)
Arsenic	0.76	0.73	0.59
Barium	672	731	748
Beryllium	0.216	0.221	0.1885
Cadmium	7.19	6.78	5.7
Chromium	52.6	42.6	33.7
Copper	546	237	238
Lead	18.9	25.9	24.3
Manganese	27.1	38	32.6
Mercury	0.002	0.004	ND
Nickel	20.7	15.8	14.65
Selenium	0.3	0.2	ND
Silver	0.049	0.059	0.045
Tin	17	20	19
Titanium	384	510	507.5
Zinc	567	496	428

Analyte	Sample 1 results (mg/L)	Sample 2 results (mg/L)	Sample 3 results (mg/L)
Total solids	44.85	35.1	36.2
Total organic carbon	39.3	40.5	41.7

Analyte	Sample 1 results (mg/L)	Sample 2 results (mg/L)	Sample 3 results (mg/L)
VOC’s			
Vinyl Chloride	ND	ND	ND
1,1-Dichloroethene	ND	ND	ND
MEK	ND	ND	ND
Chloroform	ND	ND	ND
Carbon Tetrachloride	ND	ND	ND
1,2-Dichloroethane	ND	ND	ND
Benzene	ND	ND	ND
Trichloroethene (TCE)	ND	ND	ND
Tetrachloroethene (PCE)	ND	ND	ND
Chlorobenzene	ND	ND	ND
1,4-Dichlorobenzene	ND	ND	ND
SVOC’s			
Pryidine	ND	ND	ND
2-Methylphenol	ND	0.027	0.013
Hexachloroethane	ND	ND	ND
4-Methylphenol	0.024	0.022	ND
Nitrobenzene	ND	ND	ND
Hexachlorobutadiene	ND	ND	ND
2,4,6-Trichlorophenol	ND	ND	ND
2,4,5-Trichlorophenol	ND	ND	ND
2,4-Dinitrotoluene	ND	ND	ND
Hexachlorobenzene	ND	ND	ND
Pentachlorophenol	ND	ND	ND
Total	**0.024**	**0.049**	**0.013**

APPENDIX K

MICROBIAL DATA

Identification and Enumeration of Culturable Bacteria by Water (Five Most Prominent Types (EMSL Method M009))

Date	Sample	Bacteria Identification Colony	Count CFUs (CFU/mL)	Total (CFU/mL)
7/28/08	SBR-B 072808	Gram negative rod	2,450,000	2,930,000
		Pseudomonas aeruginosa	480,000	
12/10/08	SBR-B 121008	Bacillus licheniformis	40,000	1,620,000
		Bacillus sp.	10,000	
		Enterobacter cloacae	60,000	
		Proteus vulgaris	1,510,000	

Test Parameter: Hydrocarbon Degrading Bacteria via 15 tube MPN method

Date	Result	Unit
9/26/08	<18	MPN index/100mL
10/3/08	40	MPN index/100mL
10/9/08	<18	MPN index/100mL
12/10/08	36	MPN index/100mL
1/8/09	18	MPN index/100mL
2/18/09	60	MPN index/100mL
2/27/09	78	MPN index/100mL
3/6/09	<18	MPN index/100mL
3/13/09	<18	MPN index/100mL

*Analytical sensitivity is 18 MPN index/100 mL